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STEP INTO THE CAMPUS:
TRANSFORMING PROBLEMS OF SCALE IN MASS HOUSING PROJECTS

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ABSTRACT

Berlin-Marzahn, the largest peripheral city of Berlin, is the focus of this thesis. Initiated in the 1970's it is an urban landscape of monolithic apartment blocks of precast concrete construction. This landscape lacks any ground definition and defies meaningful inhabitation by human beings. The present urban conditions facilitate unhealthy social conditions. With the fall of the East German state new needs in educational, commercial, and social facilities have developed that must be addressed. In order to creatively infill the left-over spaces lying between the mass housing blocks, and improve the quality of life of the inhabitants, it is the task of urban planners and architects to retroactively devise urban strategies and develop architectural projects that address not only the physical conditions, but also the psychological conditions of this place beset with such difficult circumstances.

This thesis sets out to address both the physical and psychological problems through the design of a campus. The physical structure of a campus and the mental and psychological aspects of education can establish community coherence and identity in the presently incoherent and dysfunctional urban environment. The premise of this thesis is that by laying out a campus within the existing undefined city the functions and the sense of community found in a small town will be created within the urbanity of the masses of people who are already in Marzahn.

THESIS SUPERVISOR
TITLE

: DIMITRIS ANTONAKAKIS
: VISITING PROFESSOR OF ARCHITECTURE

DEDICATION

This thesis book is dedicated in memory of my father,
Wolfgang Helmut Pein.

My memories of your kindness and of your work ethic have guided
me throughout my long pursuit of an education.

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CHAPTER ONE

CITY DEVELOPMENT

1.1 BERLIN'S GROWTH

This part is purely composed of maps, giving the reader a background of the development of the city of Berlin.

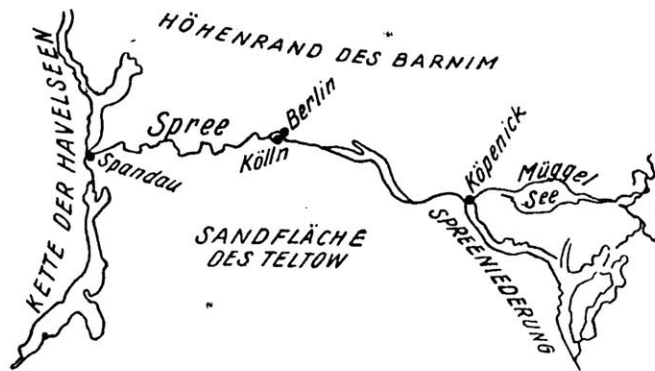
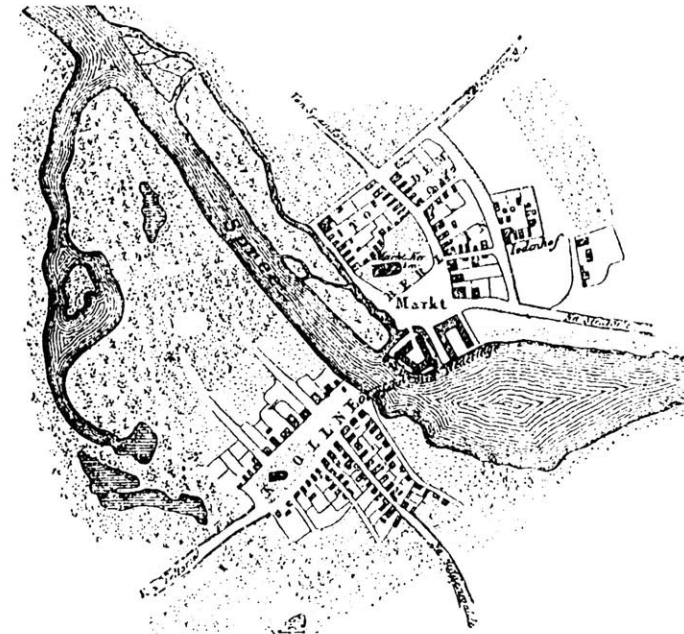
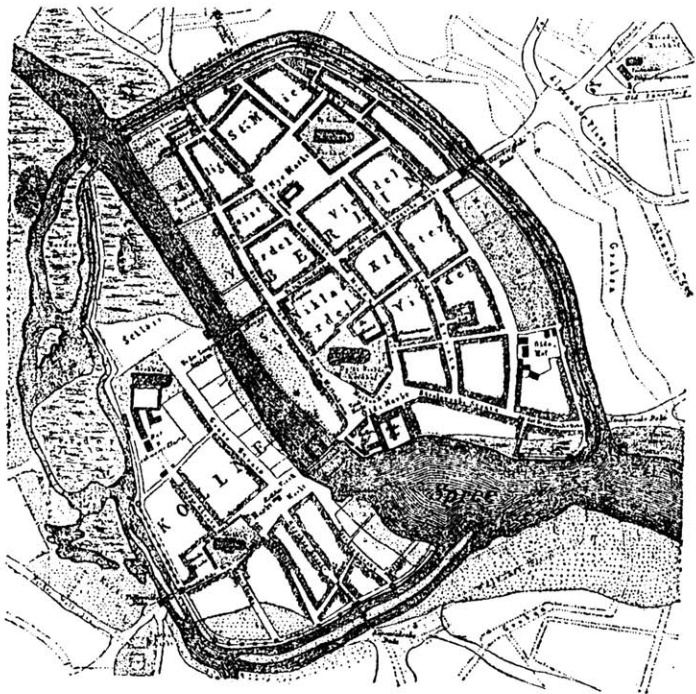


fig. 1 first settlements of Berlin and Kölln



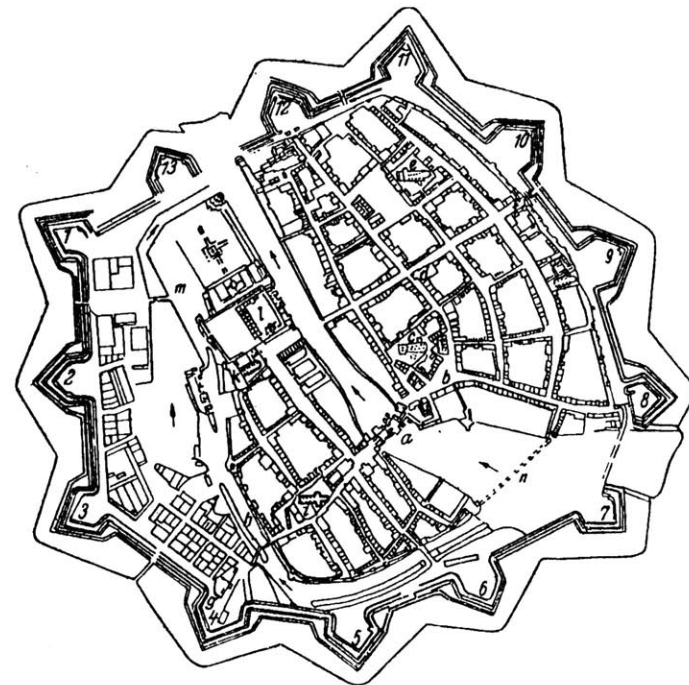
Berlin und Kölln im Anfang des 13. Jahrhunderts
Wiederherstellungsversuch von K. F. v. Klöden

fig. 2 Berlin and Kölln in 13th century



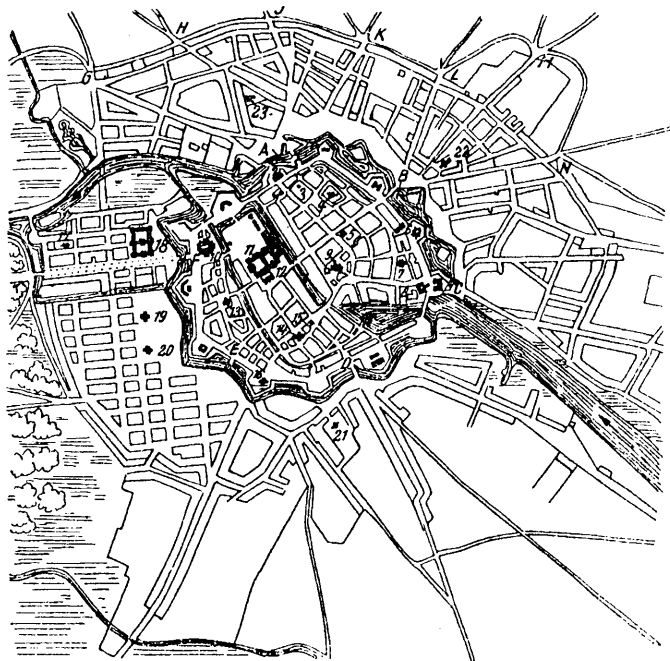
Berlin und Kölln gegen Ende des 13. Jahrhunderts
Wiederherstellungsversuch von K. F. v. Klöden

fig. 3 Berlin and Kölln at the end of 13th century



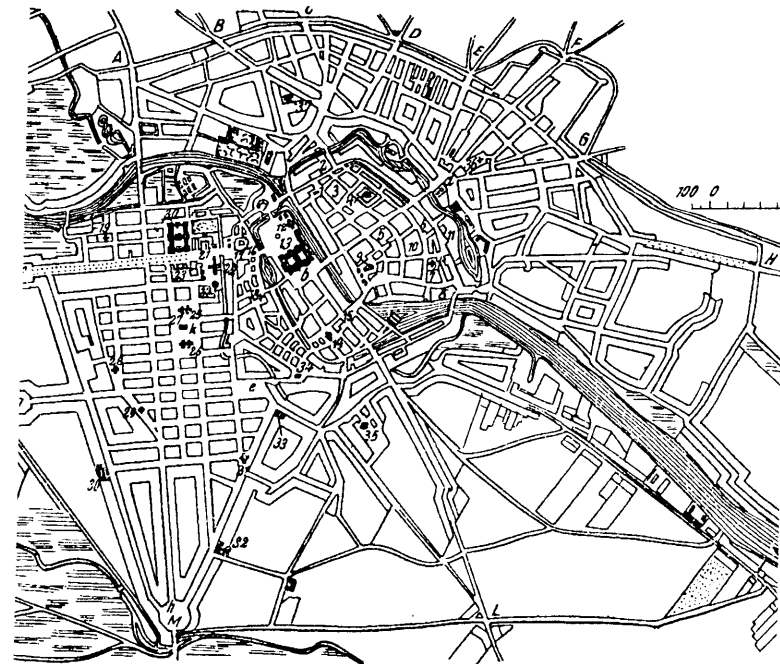
Berlin mit den Festungswerken um 1660
Plan in den Lindholzschon Papieren

fig. 4 Berlin with fortifications around 1660



Berlin im Jahre 1723

fig. 5 Berlin in 1723



Berlin im Jahre 1789

fig. 6 Berlin in 1789



fig. 8 transporting prefabricated elements of housing

"The usual process treats buildings as isolated objects sited in the landscape, not as part of the larger fabric of streets, squares, and viable open space."¹

"Designers and builders influenced by the Modern Movement abandoned principles of urbanism and the human dimension of outdoor space established in the urban design of cities of the past. The profile of the Medieval or Renaissance city, [I], is generally low and horizontal, and there is usually a close connection between life inside the buildings and activity on the streets."²

"Functionalists assumed that there was a relationship between platonic solids and human happiness."³

1.2 THE PERIPHERAL CITY

1.2.1 Historical Development of Marzahn

Berlin-Marzahn is a peripheral city of Berlin, located about 40-50 minutes, using public transportation, to the east of the center of Berlin, Alexanderplatz. This *Schlafstadt* (dormitory city) was first conceived of in the late 1960's as a solution to the growing need for housing in the German Democratic Republic. At that time the socialist/communist government provided housing in a democratic way by using pure forms in a functionalist approach. This housing was constructed with prefabricated technology and employed indiscriminately in all of East Germany, Eastern Europe and the former Soviet Union.

Berlin-Marzahn, the largest peripheral city of Berlin, is characterized by five to twentytwo story, concrete-paneled apartment blocks (*Plattenbau*). Around 57,000 apartments house approximately 150,000 people. Marzahn was conceived of and built in phases that would house approximately 30,000 people at a time.

The decision to develop Marzahn into a *Großsiedlung* (large settlement) was encouraged by many different factors. In the 1960's a water treatment plant was located nearby. With its construction, uninhabited land that had previously been used as *Rieselfelder*--land where human waste is deposited--became potential land for construction (*Bauland*). In 1972 the *Heizkraftwerk Nordost* (heating plant north-east) was built. It would provide a large area with



fig. 9 Berlin Marzahn in 1994



fig. 10 partial aerial view of Berlin Marzahn

heat from that time on. Then, in 1976, an electrical powerplant was established. A train connection from the interior of the city going north-east into Brandenburg could easily be converted into a local public transport line with frequent stops. This line was partially converted in time for the workers of the housing projects to arrive by it. Streets leading from the city center of Berlin towards the east were enlarged and newly built. A tramway was built and continuously improved upon. Industrial areas offering about 50,000 jobs were located nearby, deeming the *Großsiedlung* attractive to many.

The foundation of the first apartment block was laid in 1977. This first agglomeration of mass housing blocks is in the most southern part of Marzahn, inserted into the context of a small, domestic fabric created in the early decades of this century. The land within this original fabric is parceled into plots of about 20 m x 40 m and inhabited by very small private houses. Many plots are occupied by tiny vacation/ weekend houses (*datchas*) where hand-selected, politically active citizens of East Germany were allowed to build. This fabric is in a rather unfortunate position in Marzahn. The mass housing blocks that were dropped into its proximity hardly acknowledge the presence of the surrounding fabric, and make an alien intervention within this context, dwarfing the existing houses and denying privacy to them.

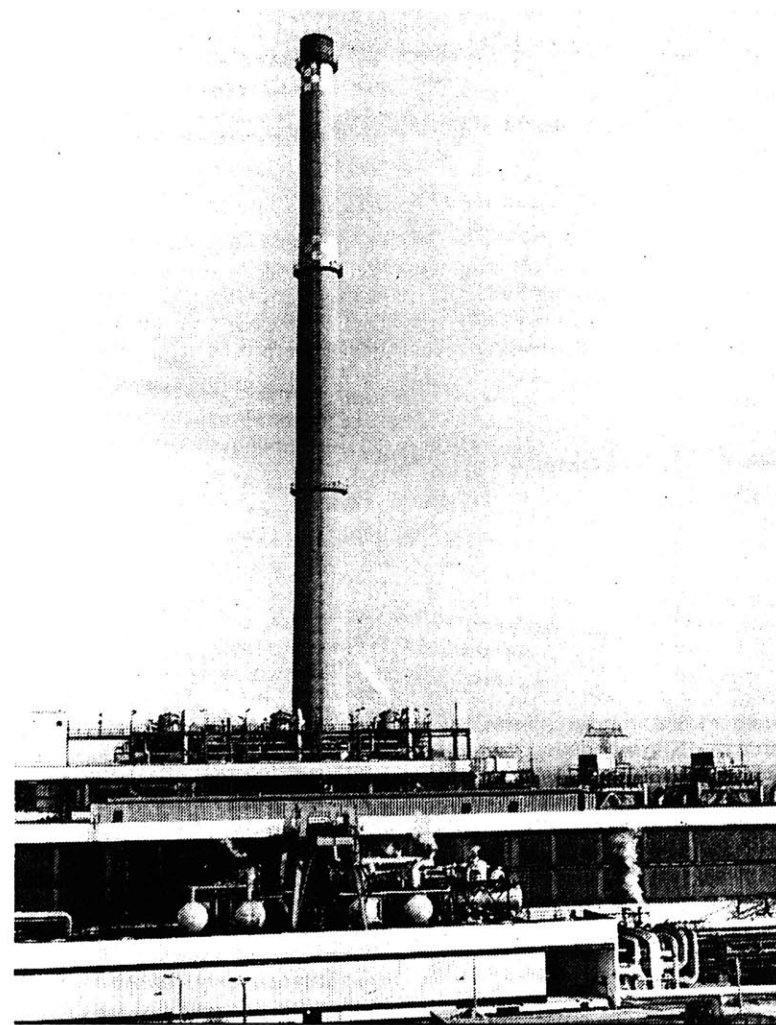


fig. 11 Heizkraftwerk North-East; power plant



fig. 14 Berlin-Marzahn - mass housing and supermarket

1.2.3 Commercial

During East German times the government provided only the most basic shopping centers in order to satisfy the most elemental needs for food. These *Nahversorgungszentren* (local supermarket) were built using a prefabricated construction system and were placed selectively throughout Marzahn. More specific and slightly more sophisticated shopping could only be pursued within the center of Berlin, 50 minutes from Marzahn. There was no possibility for the people in Marzahn to stroll down a street and window-shop.

The reason for this was linked to the larger industrial situation of East Germany. Over the years, East Germany was not producing enough goods and products for the international market and consequently the financial situation gradually worsened. This was an all encompassing phenomenon of the East German state. It affected all aspects of life, but had a most pronounced effect on the built environment. Architecture was constructed to serve just the most basic needs of the population, and therefore addressed everything in a most functional approach.

This attitude toward the built environment also affected the mental attitude of the people. The public environment created an atmosphere that prohibited pleasurable inhabitation. People lost respect for the places that were offered to them outside of the front doors of their mass housing blocks.

During East German times this public territory was at-

tended to by youth groups organized by the schools who kept them fairly clean. However, after the fall of the East German state, the lack of amenities and public space has become a much greater problem. On the one hand, people have much greater expectations on their environment; brought about by the direct comparison to West Berlin and its public amenities and life. On a more basic level, the social structures that held people together and in many ways forced them--through organizations--to partake in the upkeep of the public realm, have disintegrated.

As a result of the fall of the East German state and the introduction of capital through the market economy the possibility for improvement is now available. New strategies being developed by the urban planning authorities are planned to surpass a single-minded *cosmetic-improvement-strategy* and address, in their minds, the most pressing problems: a deficient urban life and the commercial and cultural requirements of the 150,000 people living in the peripheral city.

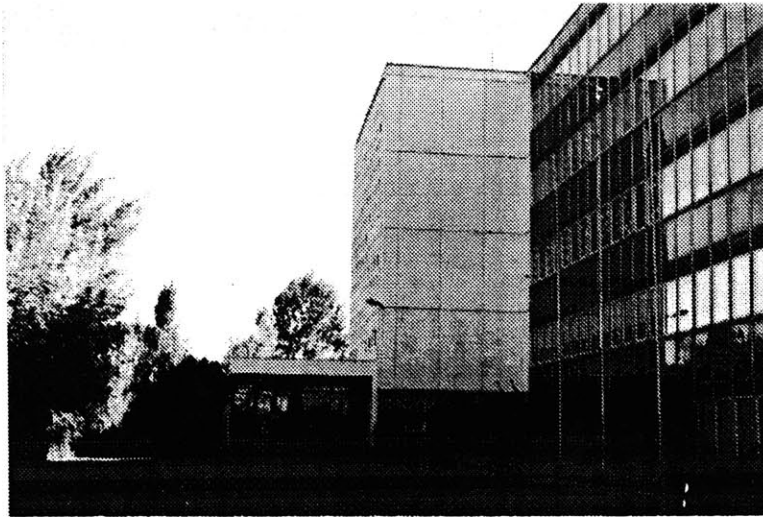


fig. 15 Berlin Marzahn - elementary school

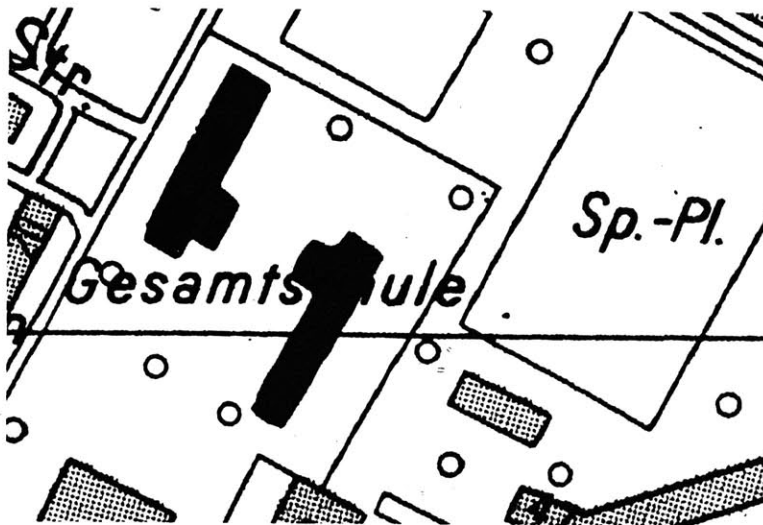


fig. 16 Plan of typical prefabricated school

1.2.4 Education

During East Germany times most school children finished a mandatory ten year school education, then went on to vocational training. Approximately 10% of all students were selected as worthy to receive a secondary school education leading to a high school diploma, achieved after 12 years, that would allow a student a university education. The worthiness of a student for higher education was based mostly on a combination of intellectual potential coupled with the appropriate political conviction in this communist country. It was a rather foul process that demanded strong "convictions" on the students' part toward the state and resulted in a highly charged psychological environment in school. This environment was characterized by distrust between students as well as between faculty and students. Expressing one's true opinion could easily jeopardize one's future and career, and in extreme cases could result in political prosecution of the student(s), their parents, and families.

The schools and the school grounds used the same construction as the mass housing complex itself. Schools were constructed with the exact same prefabricated slap-concrete construction. The school buildings were five floors and had exactly the same minimal relationship with the ground as the housing blocks. The school grounds were asphalt paved areas; fenced in for protection.

1.3 THE PRESENT SITUATION

1.3.1 Housing

With the collapse of the Communist state and the introduction of private and governmental capital, consideration is now being given to the mass apartment blocks of Marzahn. The procedure for improvement of both the apartment blocks themselves and the vast outdoor areas can be broadly summarized as cosmetic. In order to deal with the uniformity and monotony of the housing blocks the facades are often painted with bright colors. When more money is available, more thorough treatments of the facades include improvement of the R-value of the exterior walls by attaching insulating panels. These new ways of treating the facades have created ways of distinguishing one building from another. When inhabitants of buildings are asked where they live, the reply might be: "I live in the blue (red, yellow or striped) building." Even though it is nice to see that improvements for these buildings are being made, the accomplishments are rather minimal and the questions about architectural modifications have yet to be put forth. It is my desire to address the architectural issue of how the apartment blocks meet the ground, and propose alternative ways for creating entry thresholds into the building by transforming the foot of them. Thereby, I hope to create degrees of public and private domains and encourage the occurrence of a multitude of activities.



fig. 17 Berlin Marzahn - mass housing blocks, cosmetically improved with blue, red orange and yellow colors

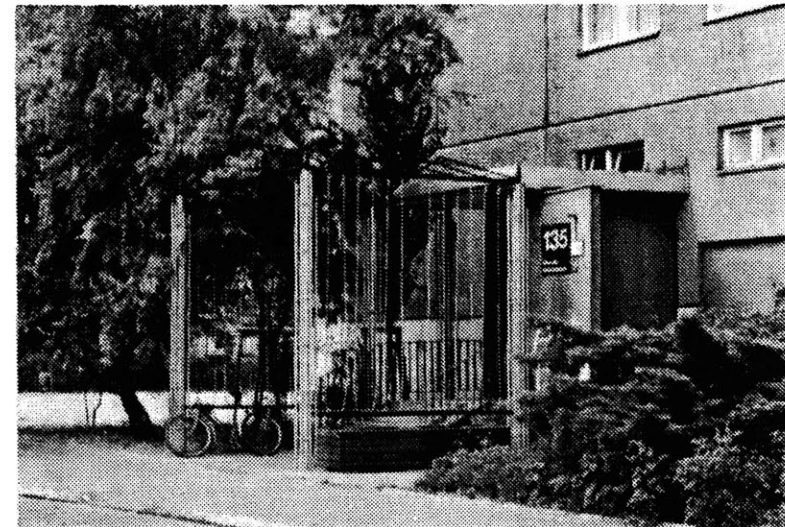


fig. 18 typical entrance to housing block, showing light weight addition after 1989

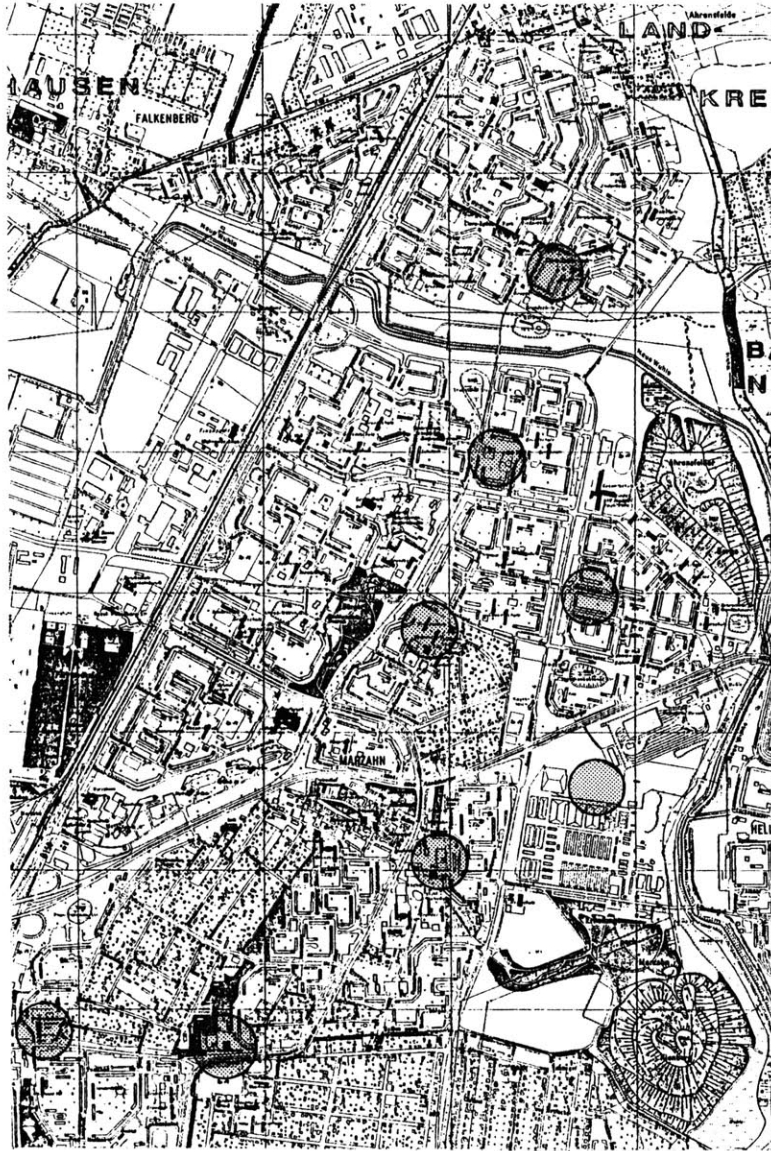


fig. 19 Berlin Marzahn with 12 proposed urban centers

1.3.2 Commercial

In order to resolve the commercial and infrastructural deficit of Berlin-Marzahn it is the desire of the city planning authorities to create twelve urban centers within Marzahn that provide a mixture of uses. Each one of these urban centers is to serve the surrounding 8000 to 12,000 inhabitants without exceeding that capacity in order to avoid initiating traffic flow into this area from other areas. An architectural and urban upgrading of the environment is the overall goal. The urban centers will incorporate spaces such as offices, commercial spaces, doctor's practices, fitness studios, cinemas and more. A multiplicity of functions should coexist in order to enrich the entire area and to provide areas in which an identity can be built.

1.3.3 Education

The school system that has been adopted in all of Germany is the model which West Germany had operated under for numerous decades. This system is much more complex than the East German one ever was. Its diversity is already felt in the lower grades, and continues to impact throughout the years. Students are in elementary school from grade 1 to 5. After elementary school it is possible to place into three different kinds of schools, depending on the students performance and abilities during the first five

years. Two of these schools, *Hauptschule* and *Realschule*, permit an education that finishes after the tenth grade. These two schools differ in their rigor of education, particularly in the areas of sciences and foreign languages. The latter is more demanding. Most students are trained vocationally after graduating from either one of these schools.

The third kind of school students can attend after elementary school is called *Gymnasium*. It is certainly the most demanding of the schools and leads to a high school diploma after thirteen years of school, one year later than in the former East Germany. This diploma is a requirement for enrolling at universities.

Since many more children are now deciding and preparing themselves for study in the *Gymnasium*, many more school facilities are in demand all over East Germany, but most pressing in cities like Berlin-Marzahn, where there is a large, young population that wants and needs to be educated.

CHAPTER TWO

THE SITE

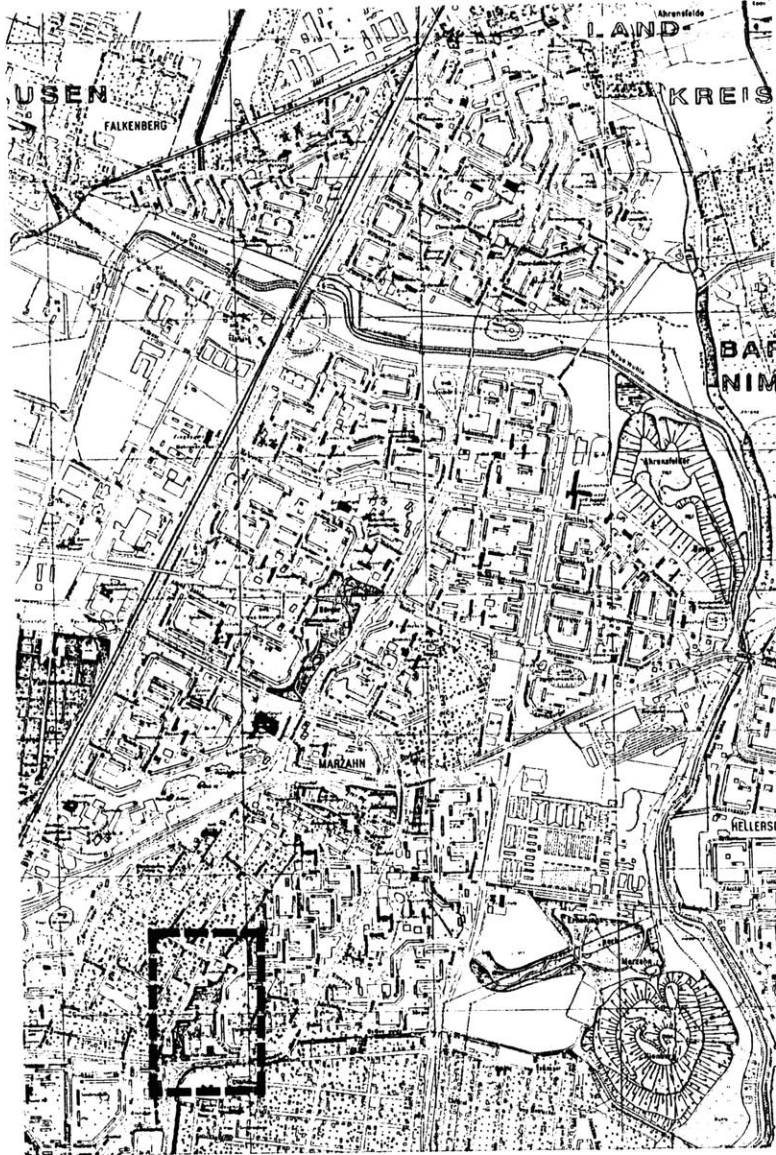


fig. 20 map of Marzahn with thesis site

2.1 Location of the Site

The Site for this thesis is located in Berlin Marzahn between Allee der Kosmonauten, Fichtelberstraße, Amanlisweg and Pakunstraße.

It is at the junction where two different environments come together; the original 20 m x 40 m parcels with dachas and small 1920's houses and the mass housing blocks. The mass housing blocks on the site are the ones created during the first phase of the development of *Großsiedlung* (large settlement). They are a manifestation of the fact that any undeveloped land in this area could simply be filled in. The first phase of construction began in 1977. Empty areas between the small housing parcels were used up by the mass housing project, truncating any natural connection of the environment.

The particular site under investigation is 500 meters in length in the north-south direction and varies from 400 meters in the south to 200 meters in the north in width. On its southern edge a major street defines the limits: Allee der Kosmonauten. This street is thirty-five meters wide. A tramway that runs in its middle separates the left and right direction of vehicular traffic. The public tram operates on a regular schedule--every 8 to 10 minutes--in both direction and has a stop on the southern edge of the site. This stop makes this the most intense point of direct pedestrian entry into the site.



fig. 21 Berlin Marzahn - site of thesis, 1969, prior to development of peripheral city

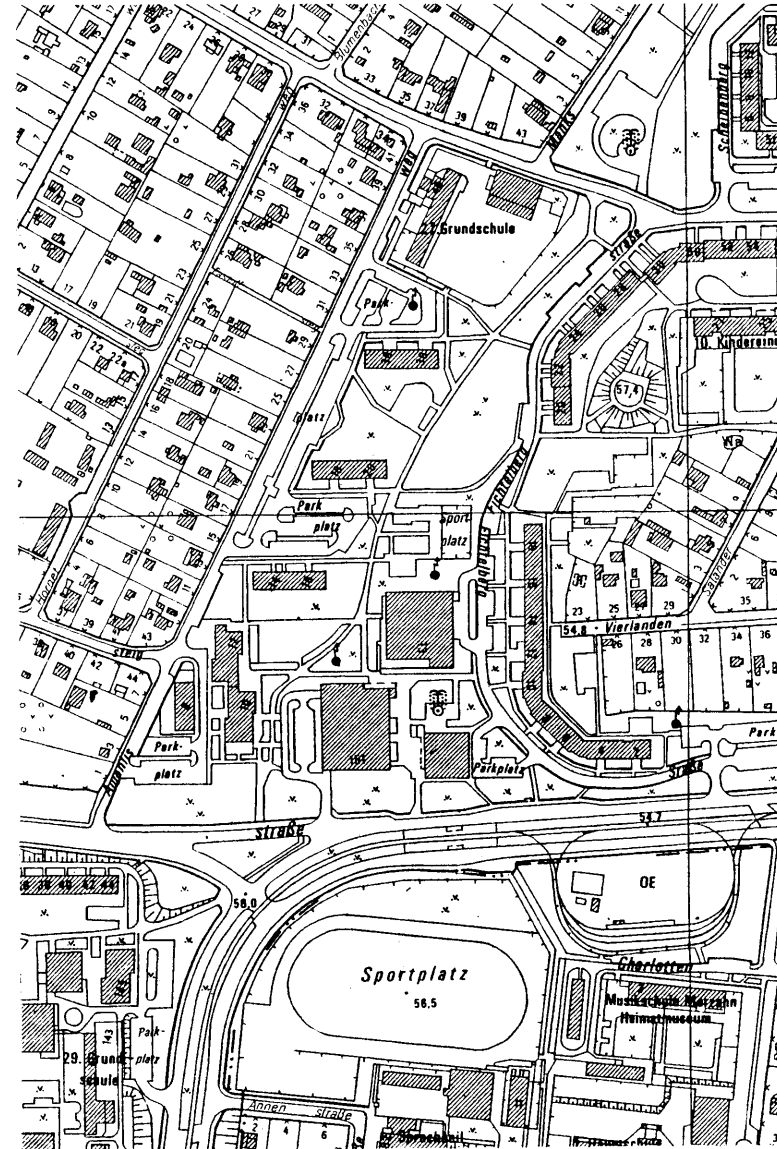


fig. 22 Berlin Marzahn - site of thesis

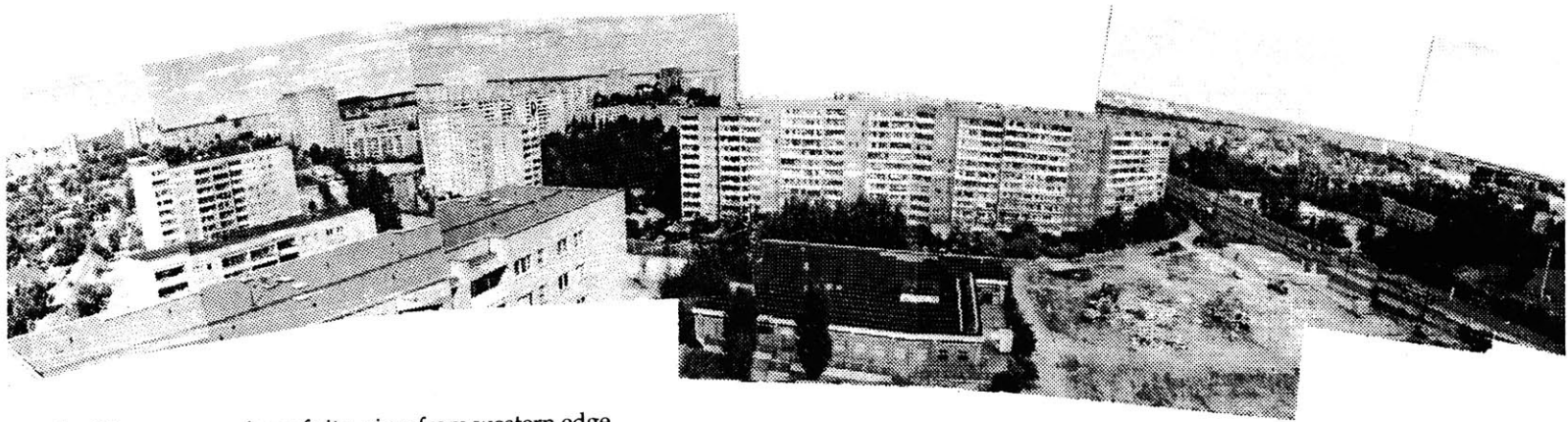


fig. 23 panorama view of site, view from western edge

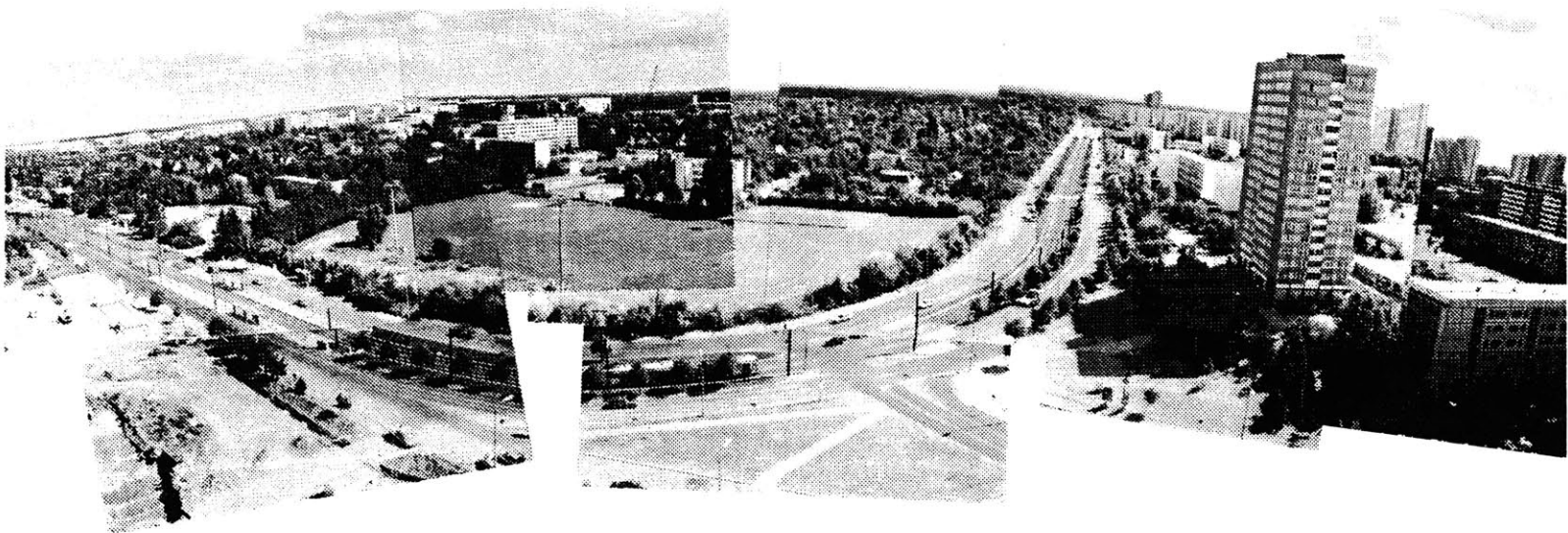


fig. 24 panorama view, view over Allee der Kosmonauten and sports ground opposite to site

The site is also bordered on the western and northern side by streets; Amanlisweg and Pakunstraße respectively. Two mass housing blocks, 200-230 meters in length, running primarily in the north-south direction, but also turning the corner to the east, create the eastern limit to the site. These two apartment blocks are of eleven floors. Their tremendous lengths create an impenetrable edge between the small grain 1920's housing environment on the eastern, other side of them. These two long housing blocks are not connected to each other but leave an opening of about 50 meters between them. A green mound is located in the back yard of the northern apartment block, in a natural pocket created by the bend in the housing block. Because it is hidden by the massive building this mound is not perceived from inside of the site. Therefore, it is rarely used as a place for recreation, nor is it recognized as a potential asset to the site.

Fichtelbergstraßer runs north-south in front of these apartment blocks. It is used almost exclusively for parking and, in effect, divides the site. It is used for parking cars by people who inhabit the adjacent buildings. A separate footpath, running parallel to the street between the buildings and Fichtelbergstraße, leads directly to the entrances of the building.

A large apartment building is located in the south-western corner of the site. This tower housing block, with a relatively small footprint, is made up of two heights. One reaches 22 floors, the other 18. To the north of it, along the western edge of the site

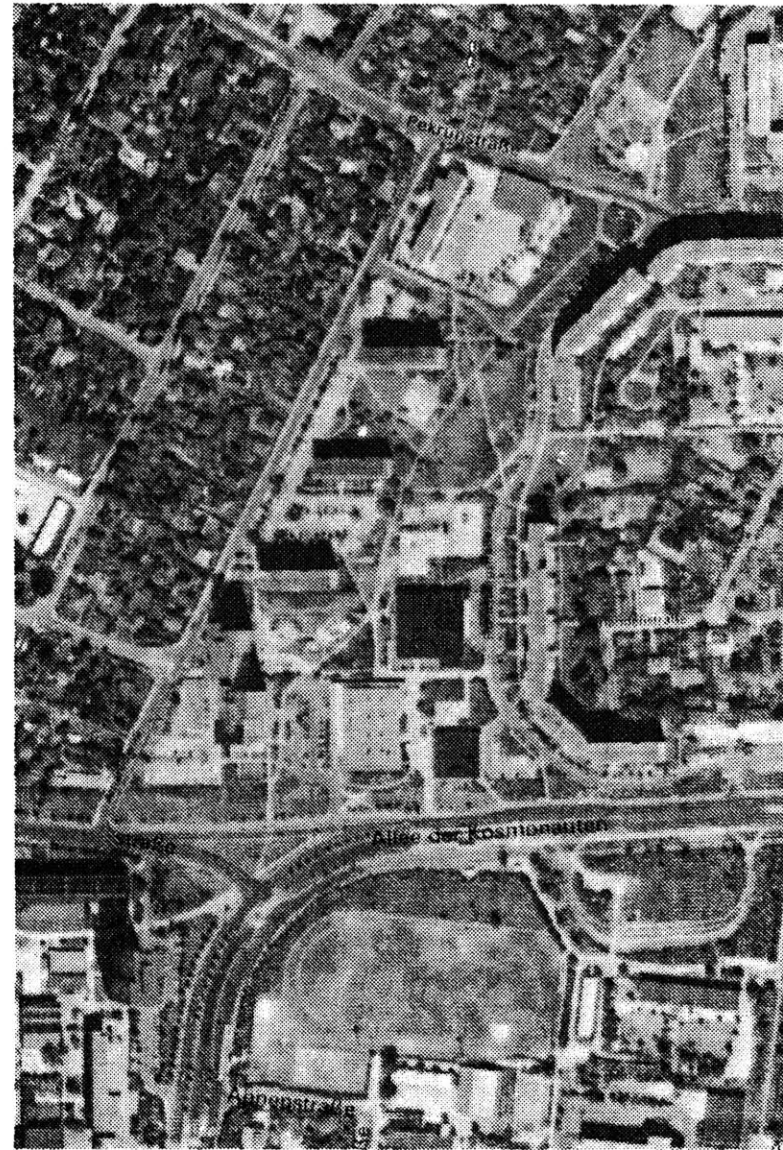


fig. 25 Berlin Marzahn - aerial view of site



fig. 26 view of southern edge of site when first inhabited in 1978

delineated by Amanlisweg, three more housing blocks are located in the east-west direction. Two of them are of eleven floors, the one in the middle is of only seven.

The very northern edge is presently inhabited by a small elementary school together with its sport's hall. Both buildings are of prefabricated concrete slab construction.

2.2 Official Urban Strategies

The southern half of the site is currently being developed into a *Nahversorgungszentrum* (local urban center). The objective of this new urban center is to serve the population--8000 to 12,000 people-- of this area in terms of commerce, retail, public amenities, entertainment and recreation. A mixture of these uses will be housed in two opposing, 4 to 6 floor, elongated building structures that frame an urban plaza. This urban plaza is open to the Allee der Kosmonauten, and receives the pedestrians arriving from the tram stop on the Allee. About 5800 sqm. of commercial area will be created for shops, restaurants, cafes, offices, doctors' practices, health and fitness establishments as well as a small number of new apartments. An old East German supermarket presently on the site will be renovated and reused within this new development.

2.3 Critique of Official Urban Strategies

Even though the authorities have good intentions for the development of this site in ways that resolve functional requirements and create urban plazas, the proposed project does not satisfactorily address the problems of the site.

The problems of the site are inherent in both the placement and design of the enormous mass housing blocks, and in the immensity of the horizontal and vertical scale produced by them, particularly in comparison to the human dimension. Because of the immense horizontal distance, buildings have no relationship to one another; isolating people. Presently, there is no threshold between the public and the private realm. From the public street and circulation paths one enters directly into the privacy of one's flat. This is due to the fact that the architecture of the high rise apartment blocks does not offer a transition zone between public and private realms. Buildings simply disappear into the ground. Therefore, the architecture precludes a multitude of activities from occurring: encounters between people, resting, or children's play.

The abstract, figural placement of the housing blocks in space, becomes even more apparent and dramatic when yet another abstract figure, the new shopping establishment and urban plaza under development, is placed within the open area between these housing blocks. In this new proposal no attempt has been made to critically address the entire territory of the site; something

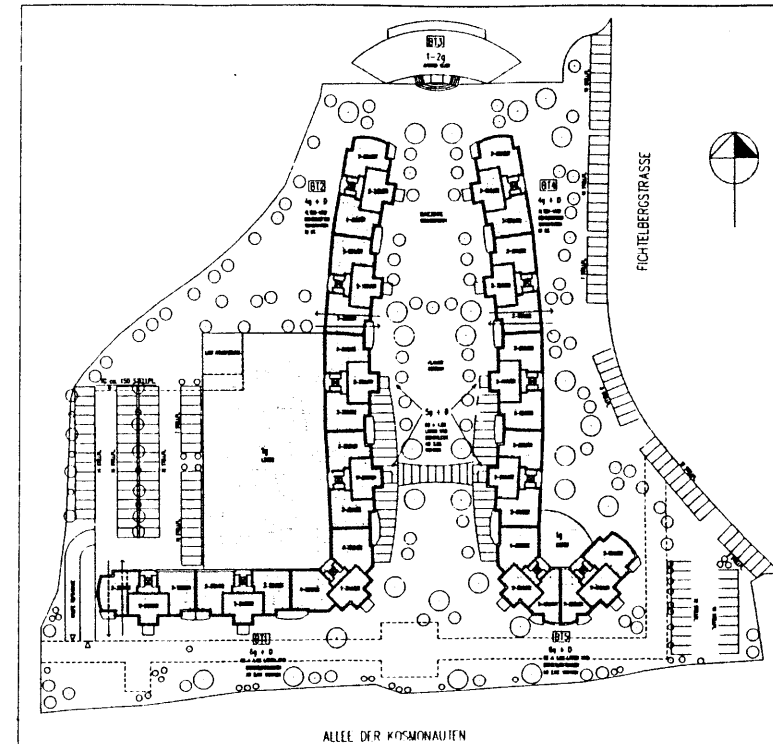


fig. 27 proposal for local urban center; presently under construction

which has the theoretical and practical potential to resolve the disconnectedness of the apartment blocks and establish a more coherent environment.

Through the placement, and more importantly, treatment of the new shopping *Passage* the existing problems of the site have become substantially aggravated. The mass housing blocks are even more isolated within the site. Additionally, none of the architectural shortcomings--such as the lack of threshold from public into private domains and the uniformity of appearance--have been addressed. The potential of the naturally existing spine, namely the eastern edge defined by the two massive housing blocks and the intense pedestrian use along their way, has not been recognized. In fact, the new official urban strategy for the site forces the movement of the people into a place, the urban plaza with its shops, without recognizing or working with any of the naturally existing circulation patterns of the site.

"Twentieth-century urban space is closely related to the almost universal acceptance of the Functionalist program for architecture and landscape architecture--a program based on ideals of pure forms and unbounded, democratic, or flowing space."⁵

2.4 An Alternative Urban Strategy: A Campus

In summary, one can say that there are three major problems within the site and within Marzahn in general that **need** to be addressed:

- 1) the issue of scale in the mass housing blocks coupled with their architectural shortcomings;
- 2) the lack of adequate commercial facilities, and
- 3) the lack of appropriate schools (primarily high schools).

The present developments in Marzahn make it clear that these issues are being treated separately from each other and not wholelistically. Buildings are improved upon cosmetically. Newly developed commercial areas do not take into consideration the true problems of isolated and abstractly placed mass housing blocks nor the inherent circulation patterns. Schools are being built without questioning the role education can play in shaping community centers in an environment still tormented by the memory of an oppressive ideological past.

There needs to be an alternative.



fig. 28 Community

"The street is the spine of the built environment. It holds the physical and territorial together.⁶

CHAPTER THREE

THE CAMPUS

A CAMPUS

In the previous chapter I described both the lay-out of the original site and present the official urban strategies. I critiqued these strategies because I strongly believe that the gravest problems of the site are not being addressed.

It is my belief that city planners and architects have to address both the physical and psychological condition in order to achieve positive results in places beset with such difficult circumstances.

This thesis sets out to address both of these problems through the design of a campus. The physical structure of a campus and the mental and psychological aspects of education can establish community coherence and identity in the presently incoherent and dysfunctional urban environment. The premise of this thesis is to lay out a campus within the existing undefined city. The campus can introduce the functions of a small town within the urbanity of the masses of people who are already there.

A campus is structured around education. Here, education, as a tool for community interaction and development, has the potential to overcome the psychological trauma of the communist ideology on human interactions. That was enhanced within the limited educational possibilities of that ideology. This, however, is not an easy task in a place that is still struggling to overcome 40 years of an oppressive ideological past. The people of

Marzahn, forced to live mentally separated from one another even though they were put into proximity of one another by living in the same mass housing complex, can be characterized by a distrust among people that results in extreme individualism. Because of disrespect for the environment, vandalism of the buildings and crime of other sorts produce unsafe and unattended territories.

Generally, a sense of community is established when people act, interact and work towards common goals beyond the individual. Within the idea of facilitating community interaction is the desire to do so across age groups; since that is the make-up of the community in Marzahn. Presently, there is a high deficit of middle and high schools in the area, and official strategies include building those facilities. However, in addition to addressing the needs of school children I want to emphasize the importance of re-education for adults made unemployed by the collapse of the East German state. To this effect, I believe that the physical environment and the administration of the school facilities can be made to incorporate this concept of integrating multiple age groups and educational purposes. Also, through smaller sized school buildings, based on an organizational structure of clusters, a campus can go even one step further in the promotion of identity and community.

A campus is often limited to a very specific age group and excludes most other people. This thesis, however, proposes a

"Education is an endeavor that is most sensitive to ambiance; students respond all their lives to memories of the place that nourished their intellectual growth."⁷

"As professionals who permanently influence the urban environment, architects, urban planners, and landscape architects have a major responsibility to meet the challenges of redesigning lost spaces that have emerged over the last five decades or so in most major American and European cities. Understanding the concept of antispace as a predominant spatial typology is essential in contemporary urban-design practice."⁸

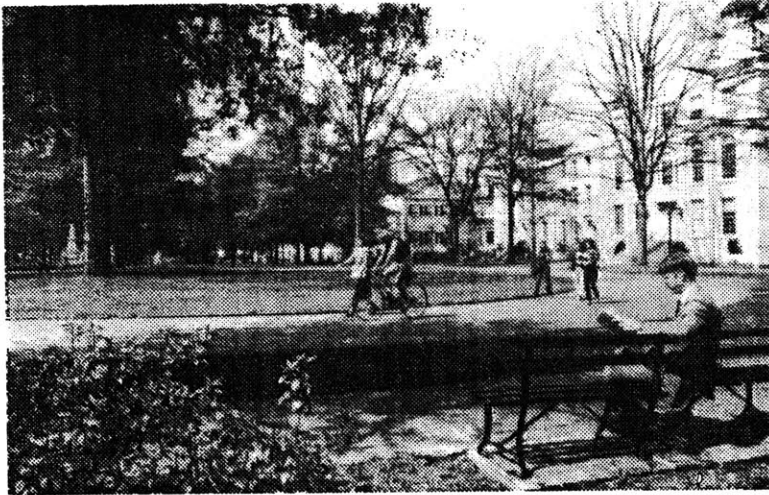


fig. 29 University of South Carolina

"Indeed, the college campus has an ambiance all its own. Like the historic village, the world's fair, the theme park, it is a place we want to go to, be in, identify with; there is a there there."⁹

"A good campus consists of a group of harmonious buildings related by various means (such as arches and landscaping) that create well-proportioned and inverse urban spaces containing appropriate furnishings-benches, pools, fountains, gazebos, and walkways."¹⁰

broad understanding of the term because of the specificity of the existing conditions. A campus can cut across age groups by creating school facilities for mid and high school children as well as adult education. The over-all organization of the campus--the circulation between the schools, the open public spaces, and the commercial facilities--can bring all age groups together. This understanding strives to be inclusive. Rather than creating a secluded, introverted community, this thesis proposes an open system, as much as possible without limits, that serves the people already there.

Building community in terms of a place means that the individual is able to identify with the environment that is located beyond his or her flat. If one is able to identify with one's environment a sense of responsibility is developed. Presently, this environment is rather alienating; mostly because the ground between opposing high-rise housing blocks is physically unstructured and undifferentiated. The immensity of the horizontal and vertical scale, in comparison with the human scale, reinforces and enhances the existing psychological problem of alienation. Therefore, any urban design proposal for a campus must address the architectural language of the school buildings, commercial facilities, and public spaces in order to accomplish the goal of building a community.

The model I propose as appropriate for the situation in Marzahn is the American small college campus. These campuses have many

attributes that are valuable to transpose into another place unfamiliar with them. Germany's university campuses are located within defined urban environments. On the German campus, a sense of campus community does not exist comparable to the American model. Their scale is much larger and the close relationships between housing, education, and social amenities found in the American model do not exist. However, even though the scale of most German university campuses is too large to be a useful reference in my site's situation, some of these campuses are still interesting for particular attributes such as circulation patterns and the communal urban spaces; especially the Freie Universität Berlin.

The American small college campus is a model for my thesis because it is all about *variation*. Campuses vary greatly from one another all across this country. These variations can be of a stylistic, as well as programmatic nature, and create environments of particular personalities. Because they promise and foster a sense of belonging through their small size and familiarity, it is often the personality of a campus that attracts students to them. Even though campuses as a whole vary, there seems to be a common understanding of what the values of campuses are and therefore what campus design should be. Campus design creates a community atmosphere through the careful placement of educational, housing, and commercial facilities within a well designed landscape setting.

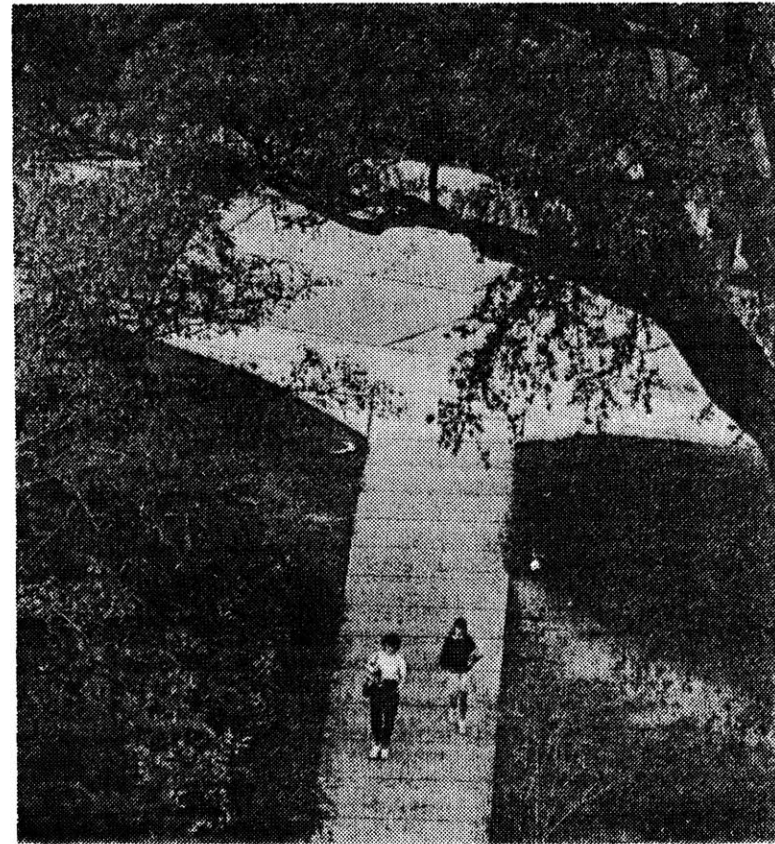


fig. 30 Louisiana State ground

"The charm of campus walkways is measure of planning success. Diversity of materials and variety of boskiness maintains interest as students wind through the [] grounds."¹¹

A campus has all the pieces to make a strong community because it is a balanced combination of three components: education, social, and living. They are inseparable. The collection of a multitude of activities within the campus setting encourages the drawing of a parallel to the function of a small town. The proposal of a campus in this thesis is not merely about providing commercial and educational facilities, but rather, it is about joining those with public plazas, a public library, a public auditorium, fitness center, public indoor pool and an amphitheater to create a coherent community whole.

CHAPTER FOUR

THE DESIGN

4.1 DESIGN APPROACH

Because this thesis project is composed of two components: the urban strategy of a campus design and the development of the architecture of the school buildings, I limited my explorations within each scale. Making certain assumptions about the validity of my decisions as I proceeded with the design allowed me to push forward and enabled me to *complete* both phases of the project.

The process can be separated into two parts:

The first part is an attempt to understand the character and scale of the dominant mass housing blocks, the open spaces, and the latent potential of the site through conceptual models. The second part uses ordering principles developed through the conceptual models, along with a sensitive understanding of hierarchies of movement, sizes and values of open plazas and buildings to design a specific campus program.

The process of design was initially generated with the help of models at the scale 1:1000. Through these study models I gained a feeling for the scale of the entire area, both vertically and horizontally, and developed an attitude towards the site and towards the buildings. This attitude was to create a structure that ties the existing mass housing blocks together and enables people to move between them in an organized way. The structure intensifies the public path along the way

through the program it will be inhabited with later as well as through the architectural articulation. Presently, people on either side of the site do not interact. It is my objective to bring the people into the space that is now left over space.

I conceived of my project as primarily low-rise from the beginning, in order to provide a change of scale to the high-rise housing blocks. By producing a low-rise campus complex and spreading out the program, I address the horizontal vastness between the housing blocks; establishing an incentive for people to move through the site.

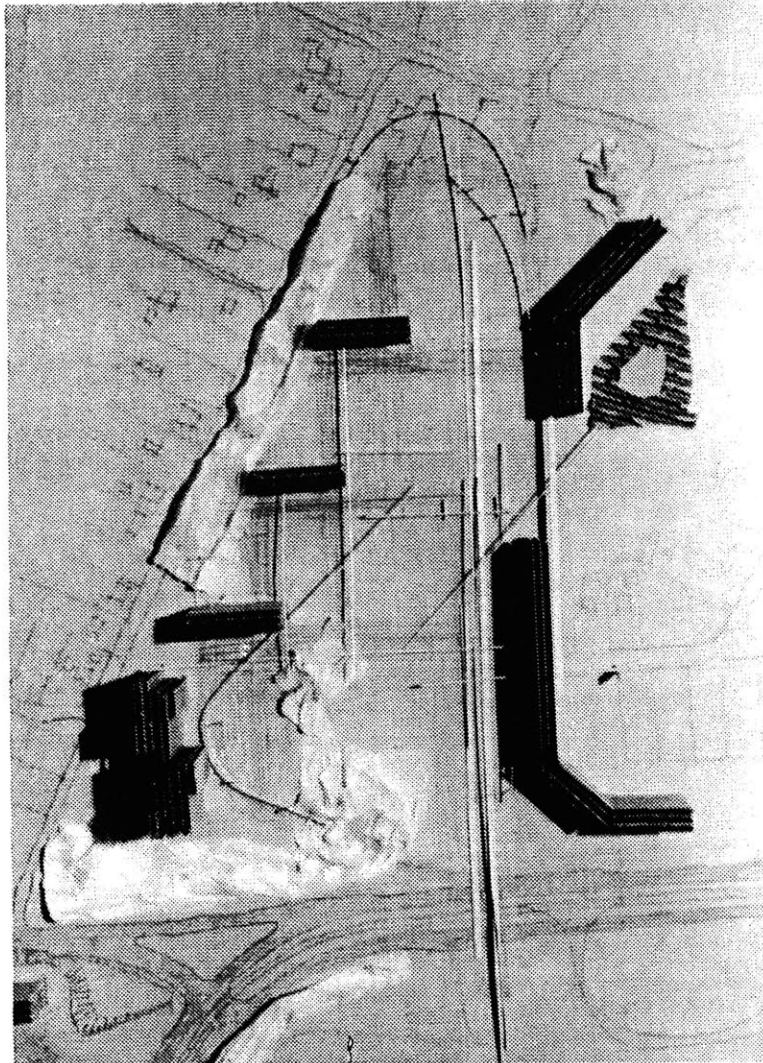


fig. 31

FIRST CONCEPTUAL MODEL

SCALE 1: 1000

This model is the first attempt at trying to establish an attitude about the site. Here, I take into account the importance of the directional character of the existing mass housing blocks to find a meaningful way of connecting these isolated objects to one another. Breaks through these massive blocks can be made in selected places in order to make viable spatial connections.

In this model the linear housing blocks on the eastern edge are used as an ordering principle to the site. My intervention intensifies the importance of that *spine*. Beginning at the tram station in the south, it leads directly north along the apartment blocks; ending in a *closing gesture* as seen in the curved form.

Off this spine I reach out into the left-over area of the site; grabbing on to the other buildings and creating formal courtyards in the action.

Importance is given to any existing natural assets, such as the green mound located in the bend of the north-eastern housing block, and in cross-connecting them to one another. Because the site is otherwise completely level, I decide to break up the monotony by introducing hilled landscapes; in the southern part of the site to buffer the site from the noise and heavy traffic of Allee der Kosmonauten, and on the western edge, along Amanlisweg, to shelter the site from parking and the street.

SECOND CONCEPTUAL MODEL

SCALE 1: 1000

This model is an attempt to adopt a more *playful* attitude towards the site than exhibited in the first model. The little sticks represent the intensity of people moving into the site. The most intensity occurs at the point of the tram stop and further into the site where it disperses into several directions. As in the previous model, the attitude toward the landscape in the south of the site is about buffering the site from the noisy street and introducing a feature that is not yet found in the flat area of the site.

The *closing gesture* to the north reflects the same attitude as previously, however, it changes its orientation to allow a *flowing* into it from areas to the north of the site. At this point I am starting to think that this curved form will have a strong community use; potentially an amphitheater.

Ideas about the development of the *spine* into a commercial area are affecting the way I look at the apartment building adjacent to the spine. My attitude turns towards completely changing the *foot* of these buildings in order to accomplish the following: accommodate parking in the lowest level; place commercial use into the next two floors of the building by elevating the street level, and through that, also elevate the entry level of the apartment blocks.

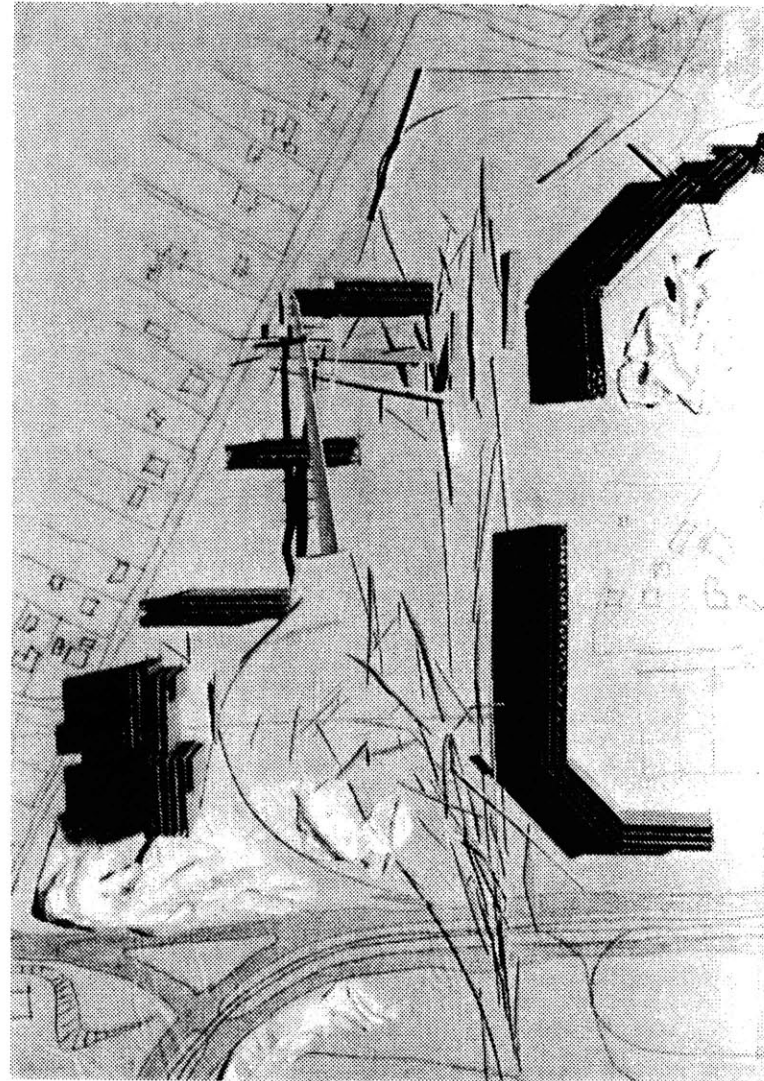


fig. 32

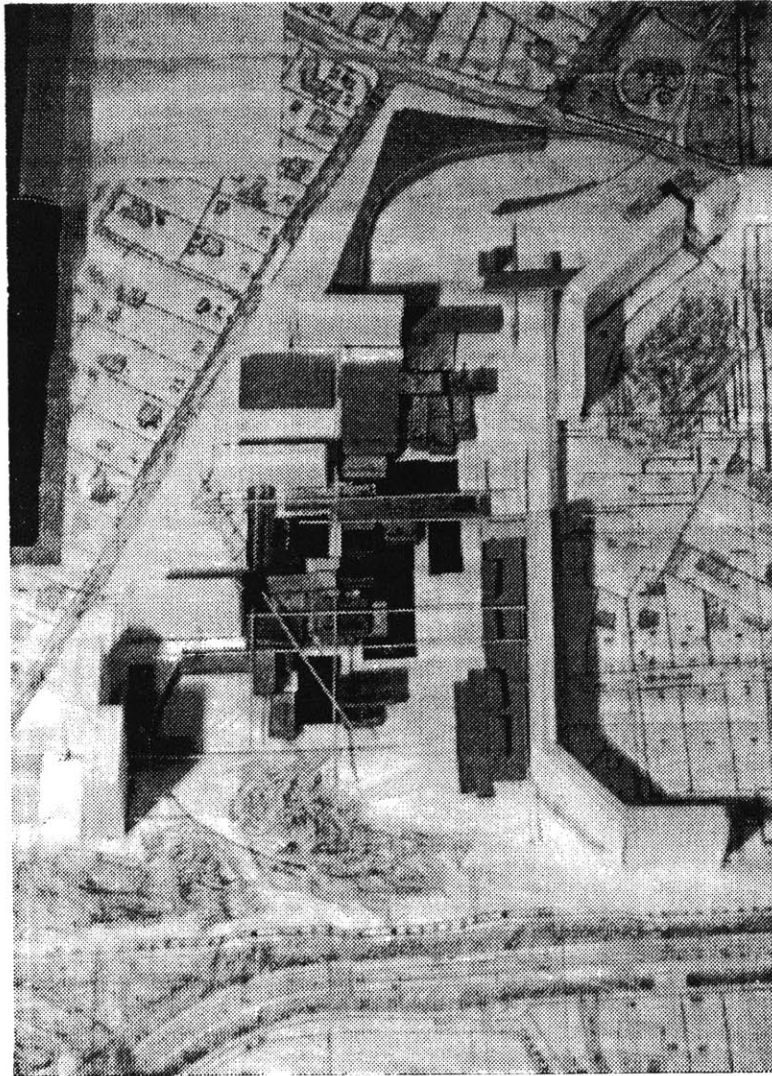


fig. 33

MODELING THE PROGRAM

SCALE 1: 1000

In order to get an idea about the approximate area that my buildings will take up, I placed massing blocks of the program into the site. I quickly realized that I had paid little attention to my previous observations about tying the different isolated objects of the site together. Therefore, I superimposed onto the programmatic model a grid-like structure that reaches across the site in an attempt to tie together the housing blocks.

The two highschools are located towards the western side of the site. Even though they have separate administrations, they share many of the special classrooms, like sciences, art, and music, in an attempt to think of the population of two schools interacting and mingling with each other. Outside recess areas for the students are broken down into smaller areas.

Placing the gymnasium revealed that these are big, awkward volumes. The question of how to deal with them arises.

The path from the tram station, across the small landscaped hill, connects to a public library.

In the northern part of the site the curved form of the previous model is filled with commercial activities. More thought was given to how people, arriving from the north, enter into the site. Again, the possibility of parking cars in the foot of the housing block is envisioned.

MODELING THE PROGRAM

SCALE 1: 500

This model begins to look at the school buildings and their inhabitation, through courtyards, of a large portion of the site. In order to begin developing a spatial and formal language it neglects many of the larger site observations and decisions I had made in earlier models. Working at this larger scale allowed me to address programmatic issues of the school abstract of the site. Classrooms are linearly strung together making longer connections. An important observation from this model is that by spreading out the footprint of the building so extremely, issues of safety for the school buildings themselves become apparent. This lay-out demands that the public pass through quite substantial parts of the building in order to cross the site.

The area between the two long apartment buildings on the eastern edge is considered to be inhabited by an important urban plaza for the site.

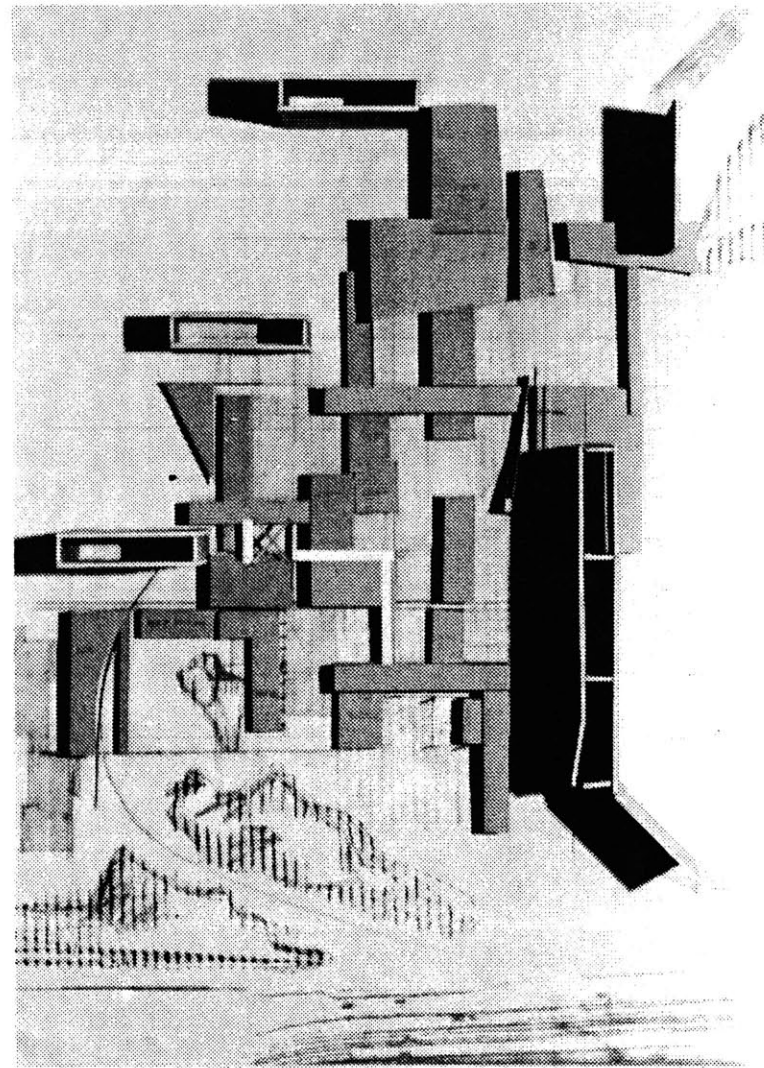


fig. 34

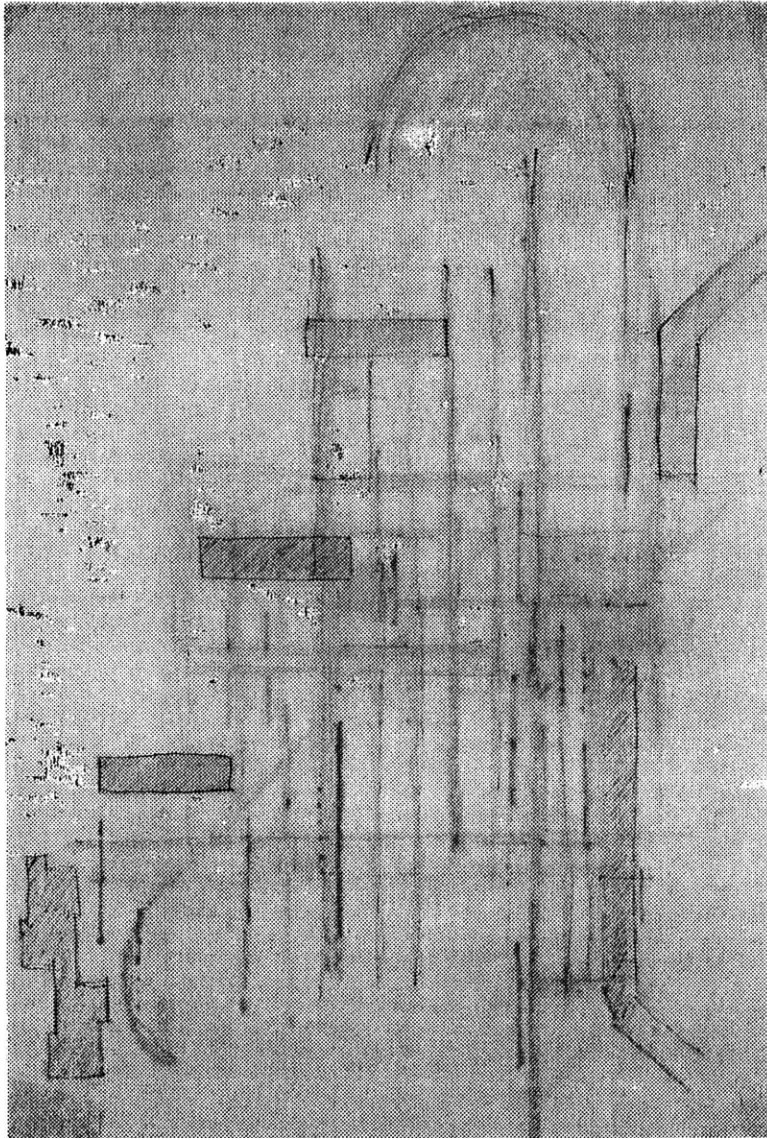


fig. 35

SKETCHES

SCALE 1: 1000

These three sketches have to be looked at together. They were produced following a discussion with John Habraken (a list of his writing can be found in the bibliography.) that touched on the following issues: this project is about making a town; a town that is made up of *normal stuff* and *special stuff* or the *thematic* vs. the *local*. Therefore, I should think about a continuous field for the entire site that is constructed out of a hierarchy of circulation, basic dimensions for the built volumes/modules, and maximum and minimum dimensions in order for light to penetrate (streets/hallways/corridors...). Lesson: "Resist the temptation to act locally."

In the first sketch, without considering the program, the site is structured throughout with a grid emphasising the north-south direction of the site. Cross-connections are made in places where the site constraints demand connection.

The other two sketches combine the earlier decisions I made about placement of both programatic pieces and of urban plazas with ideas about *field* and structural system deployment.

The main lesson of these sketches is the importance, approximate size, and placement of the urban plazas within a system of the *thematic stuff* created by the schools surrounding them.

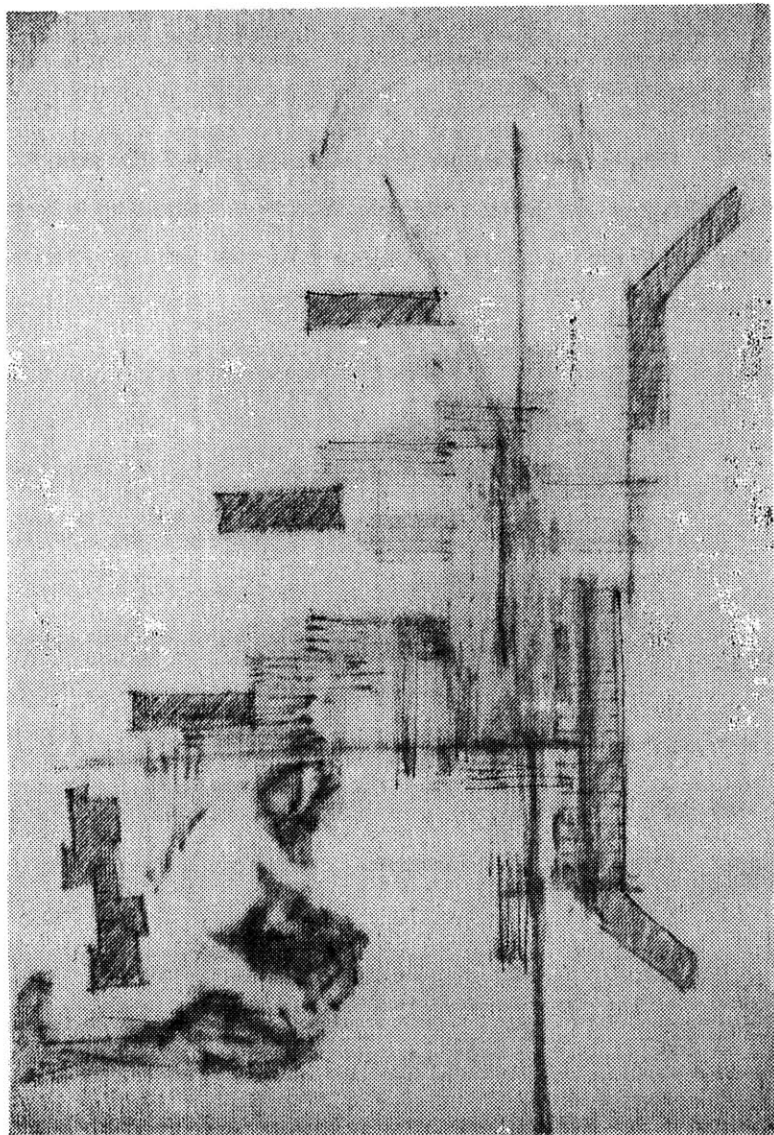


fig. 36

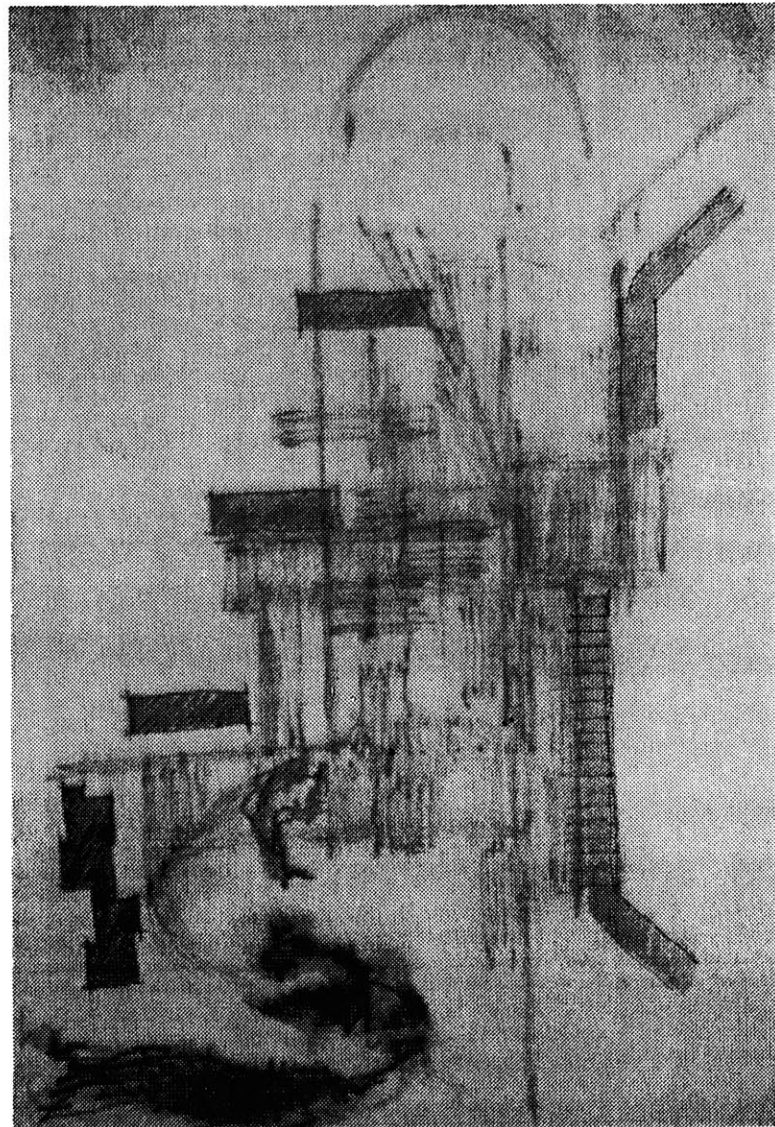


fig. 37

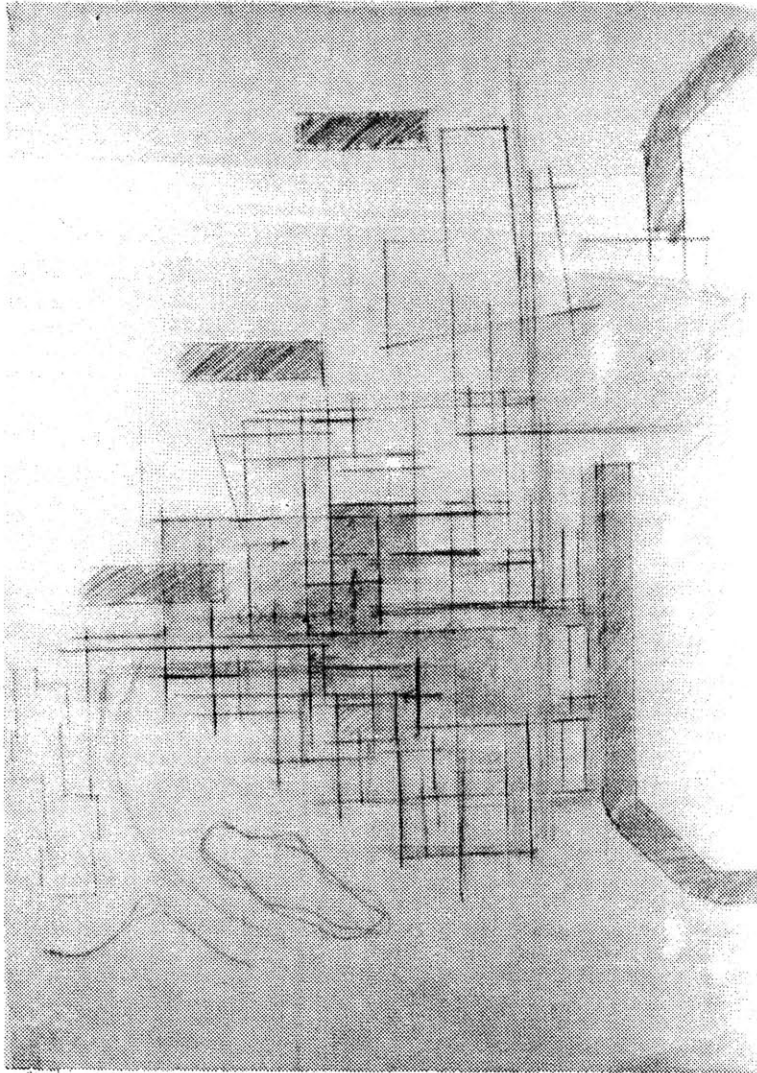


fig. 38

SKETCH

1:500

This is one sketch in a series that explored the schools; their placement on the site, their placement in relationship to each other and to the landscape, as well as their interior organization of clusters.

MODEL

SCALE 1: 500

This is a three-dimensional representation of the previous sketch. It explores further ideas about clustering within the schools. Each cluster is made up of one special classroom (science, art or music), a number of simple classrooms as well as a waiting area. The waiting area is to accommodate students who wait for the teacher to open the classroom at the beginning of the class hour.

Attention is given to the dimension and location of urban plaza between the schools.

The large volume in the south-eastern side of the building is a school/community auditorium for school events as well as community activities of various purposes. In this way the community becomes part of the school environment; part of its life.

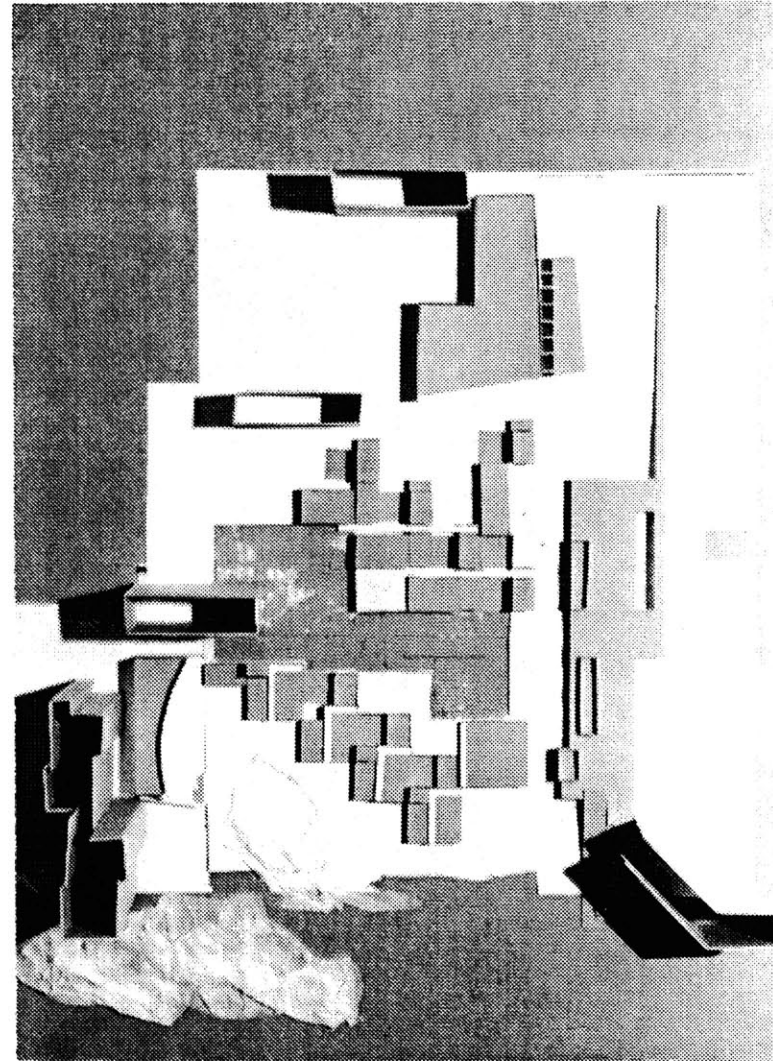
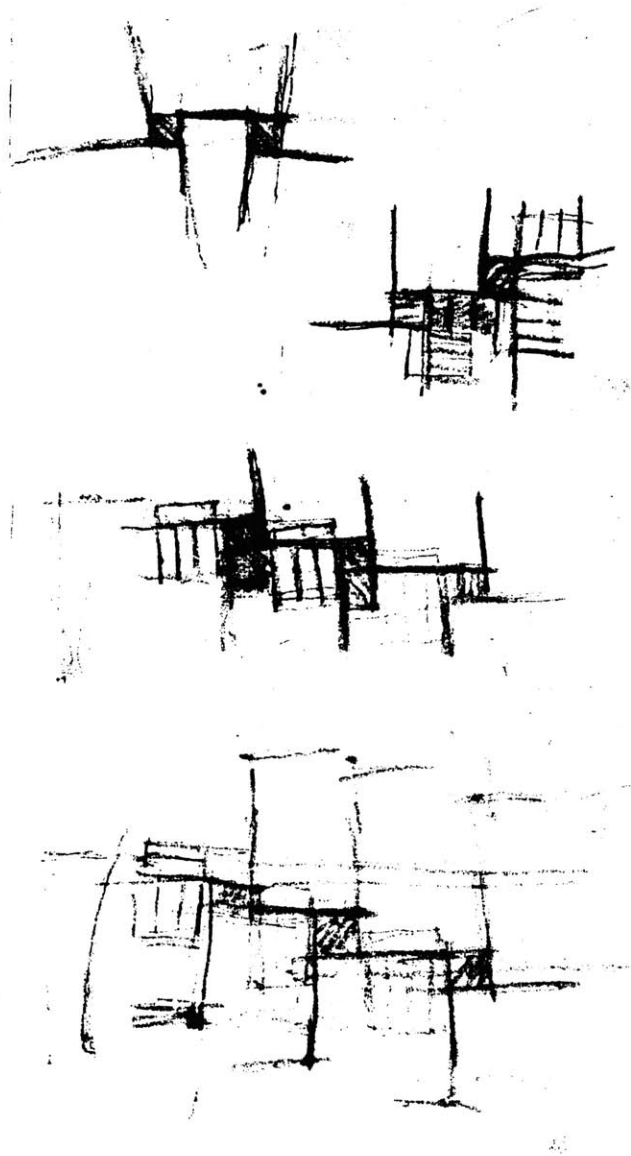


fig. 39



SMALL EXPLORATIONS

NO SCALE

All of these sketches show a progression of the idea of clusters.

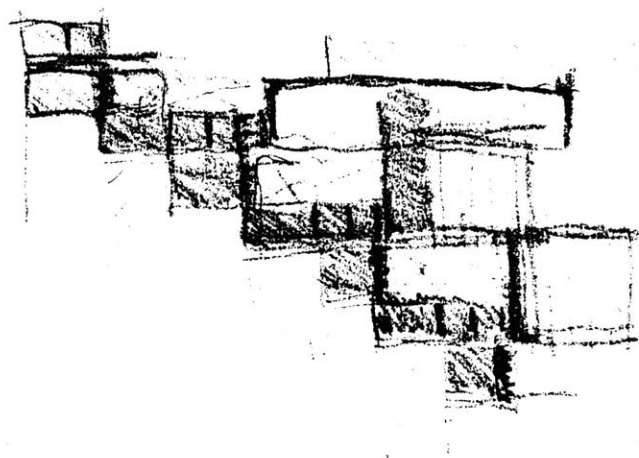


fig. 40

MODEL OF SCHOOL

SCALE 1: 200

This model shows clearly the repetition of clusters. Special classrooms are characterized by trussed walls with a high sloped roof that opens up towards the landscape or to receive northern light. Each cluster has its own outside recess area, as well as a landscaped, outdoor courtyard within the actual school building. This feature became important for the illumination of the school with light. Each cluster can host a specific age group; 11 to 12 year olds or 13 to 14 year olds. This way of grouping the students encourages more interaction among students of the same age and establishes a closer link between them.

Again, it is possible to see the presence of a substantial auditorium as part of the school. It is directly linked to the interior recess area of the school, which opens itself as a major entry point to the school.

The most northern edge of the school is inhabited by the administration.

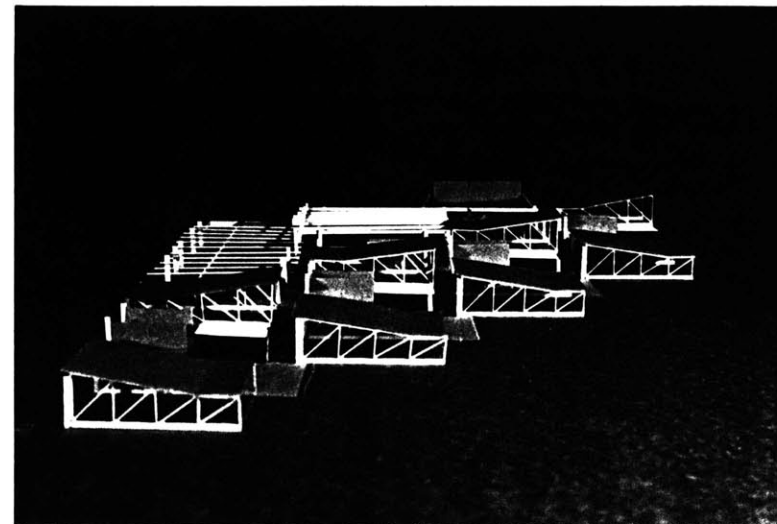
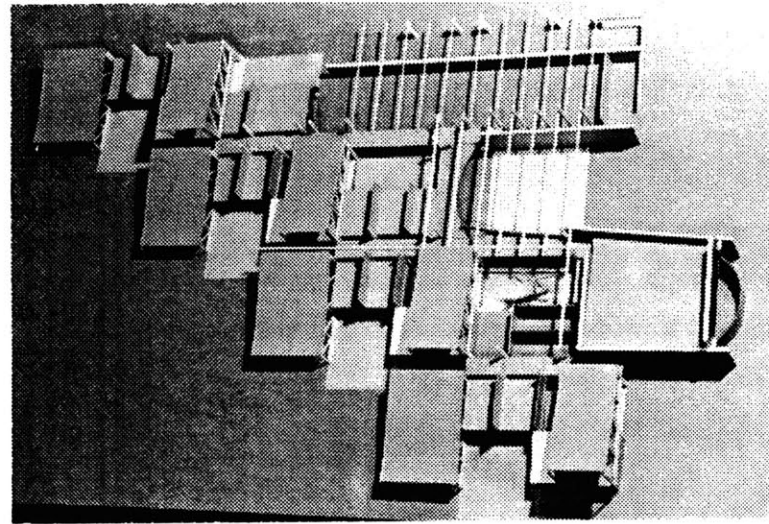


fig. 41

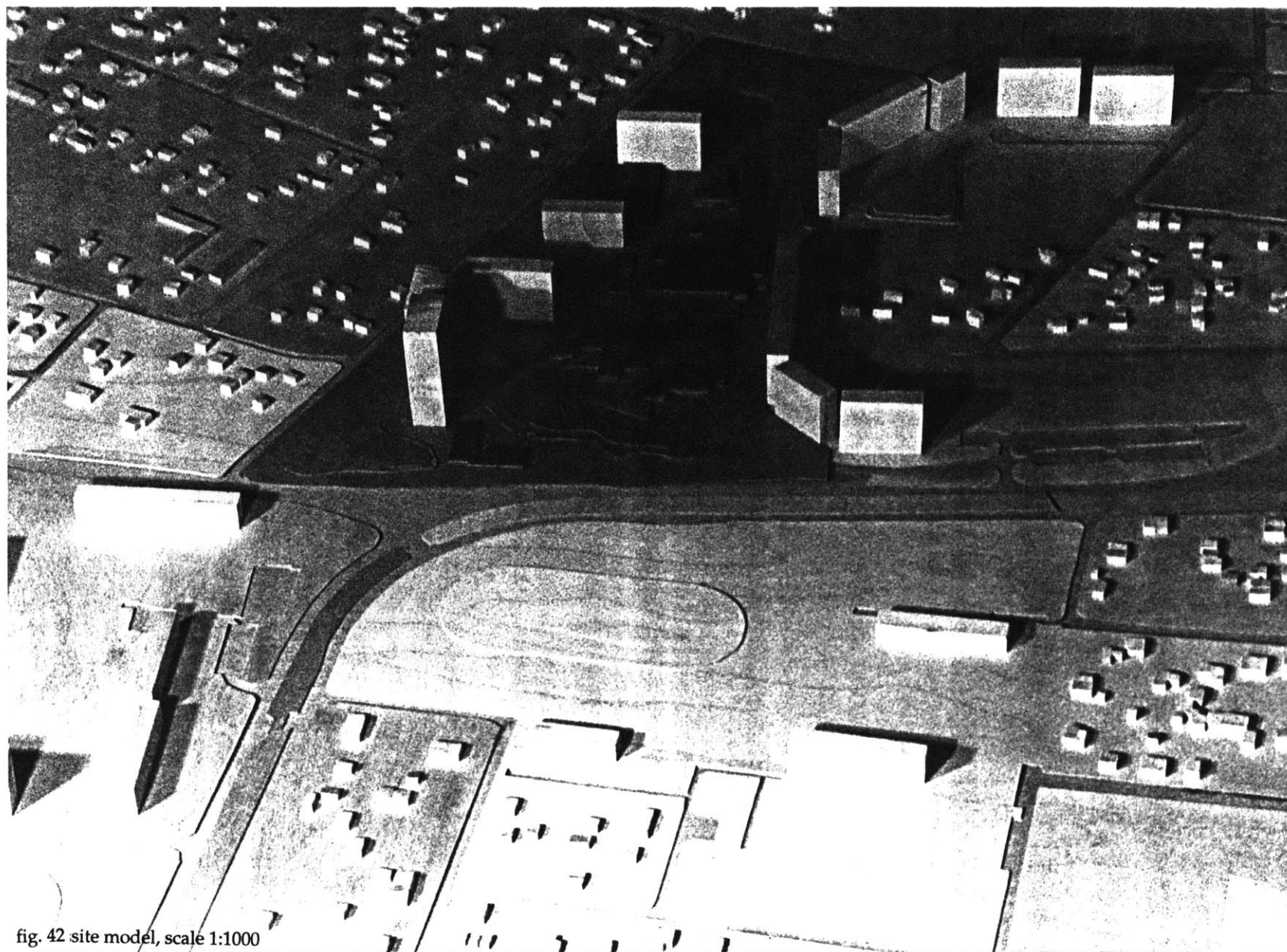


fig. 42 site model, scale 1:1000

FINAL DESIGN

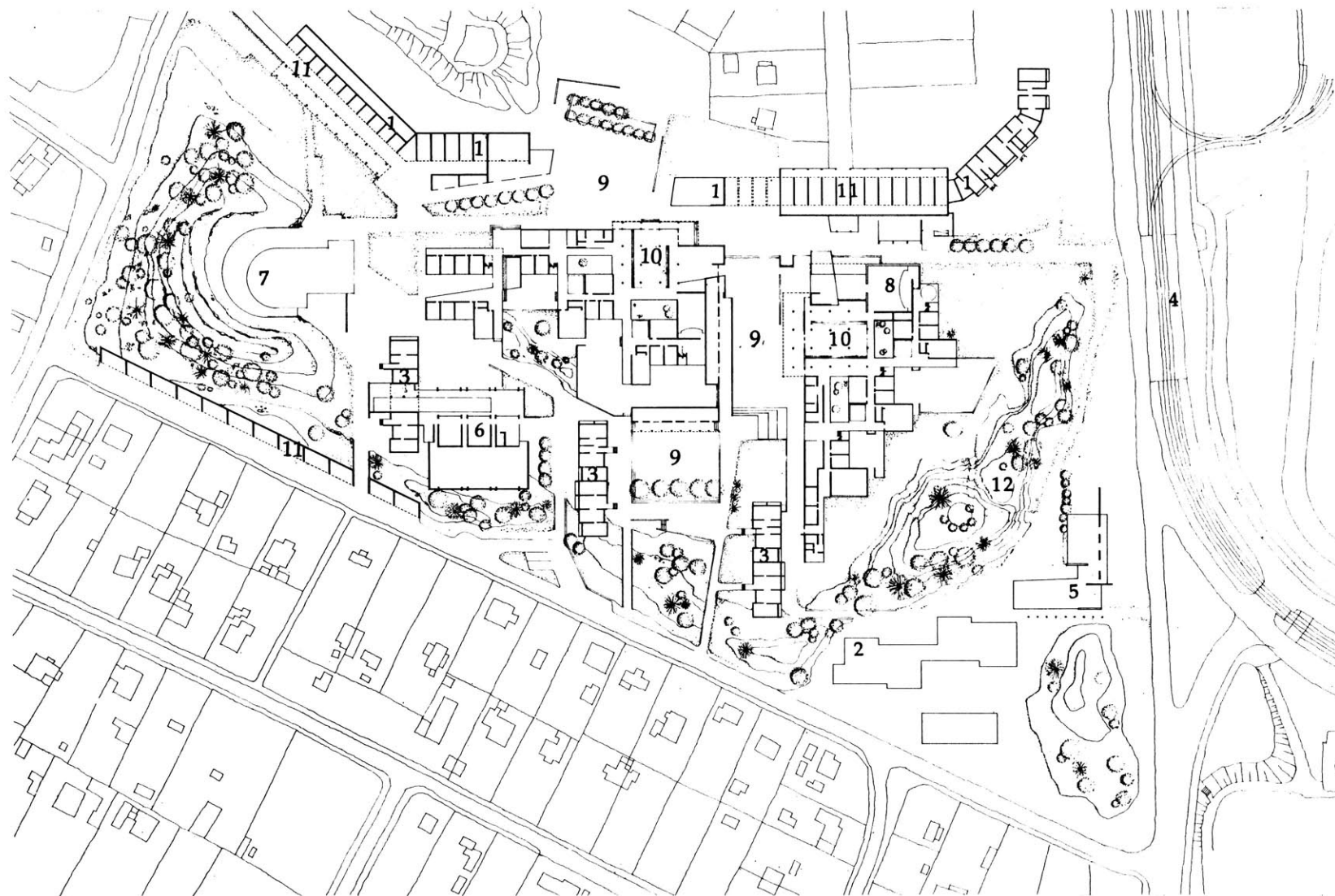
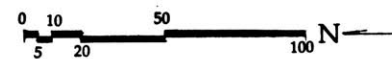


fig. 43 campus plan



THE CAMPUS PLAN

The campus as presented is composed of different programmatic elements that join the existing buildings into a coherent system of formally designed areas and natural landscape.

- 1 - existing mass housing blocks on the eastern edge of the site, buildings are of eleven floors
- 2 - existing tower housing block on the south-western corner of the site, buildings are of twenty-two and eighteen floors
- 3 - existing mass housing blocks on the western edge of the site, the middle building is seven floors, the others are eleven
- 4 - tram station on the southern edge of the site, most intense point of entry into the site
- 5 - public and children's library
- 6 - school and public gymnasium, public swimming pool, fitness center on second floor
- 7 - amphitheater; as a closing gesture to the northern edge
- 8 - public and school auditorium
- 9 - public plazas
- 10 - school buildings
- 11 - parking facilities
- 12 - natural landscape along the southern, western and northern edge of the site

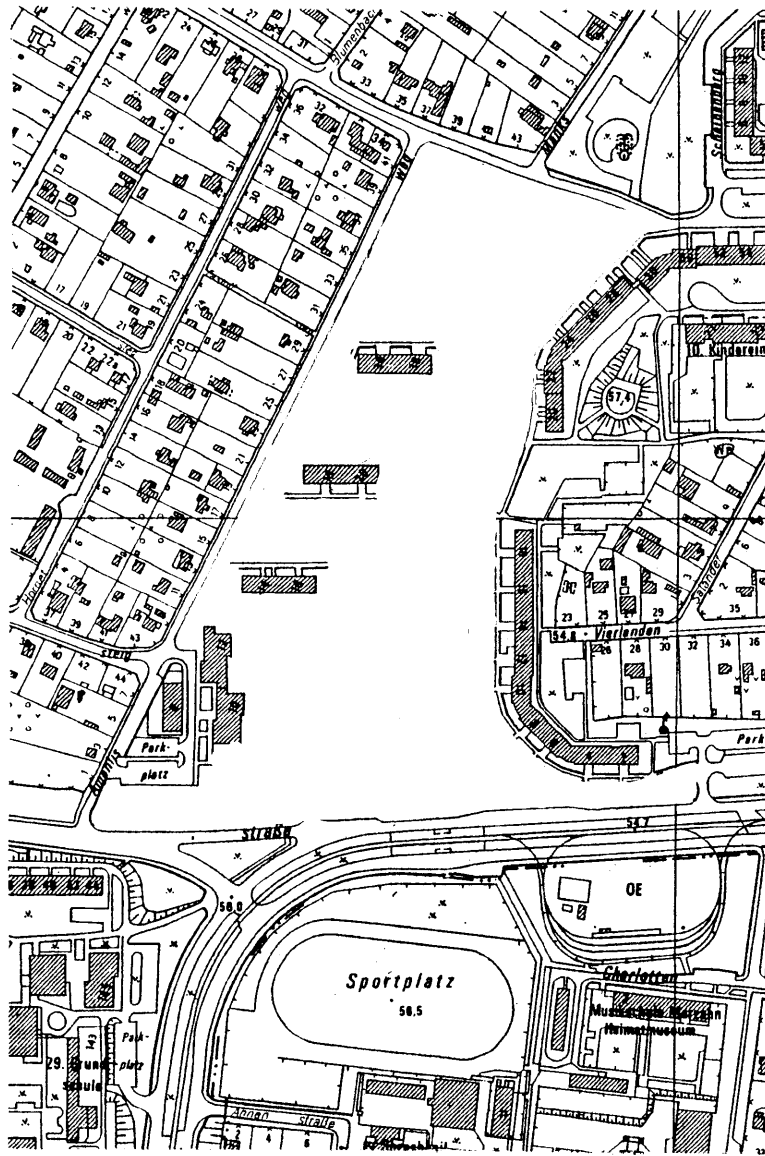


fig. 44 existing site plan

MAKING SITE CONNECTIONS

The primary decision for the site, seen in the first conceptual model, is to maintain and enhance the existing *spine* in the north-south direction along the eastern, linear housing blocks. From this spine cross-connections to the existing buildings on the other side of the site are made. The *spine* is activated by commercial activities as well as major public amenities, urban plazas and a community auditorium. It ends in an outdoor amphitheater in the north.

The most intense point of arrival into the site at the point where the tram station is located. People taking this route into the site have two options for entry. The most dominant one is to enter into the *spine*. The other option is for the people living in the tower housing blocks on the south-western corner of the site. This choice has a much different character than the commercial/urban *spine*. It is a path that is defined by the natural landscape mound which it is passing.

Within the interior of the site the most dominant circulation path is the *spine*. All other movement is subordinate to it in terms of hierarchy/intensity of use. However, the other connections are similarly important in that they are crucial to the functioning of the campus as an educational environment as well as to the functioning of the town. Each path is treated as a spatial experience for the user in addition to its functional requirements.

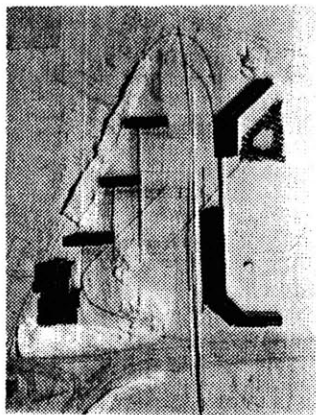


fig. 45 first conceptual model

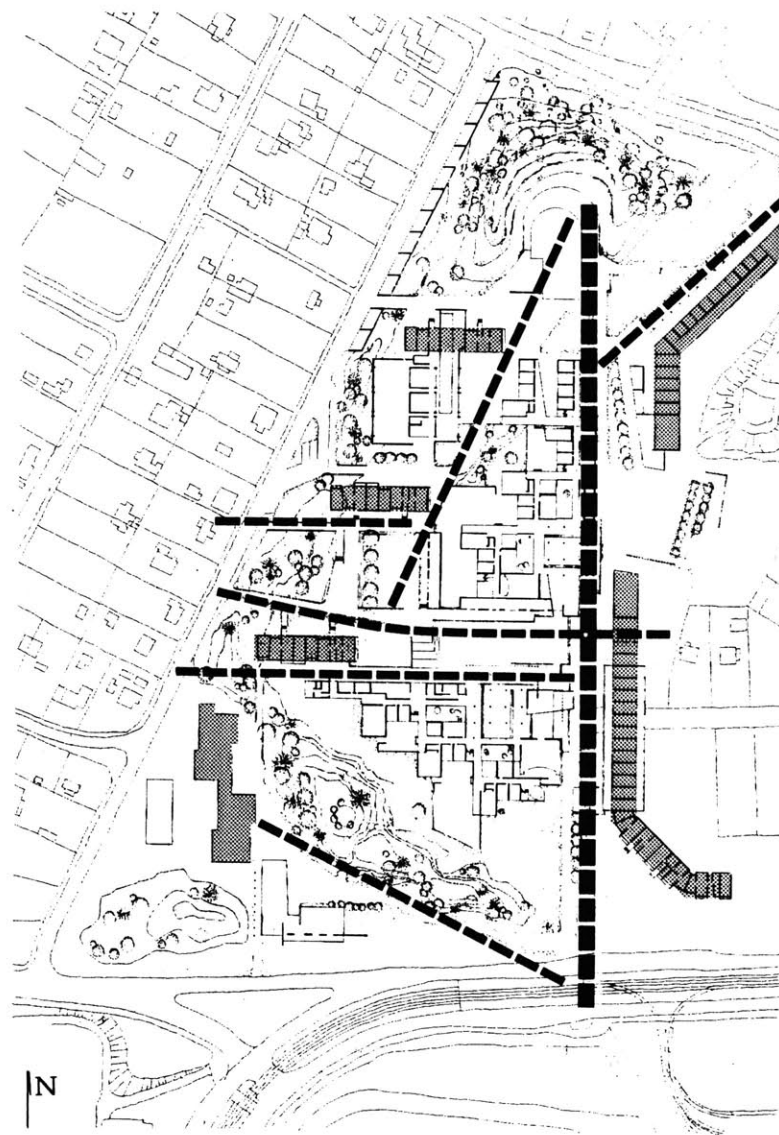


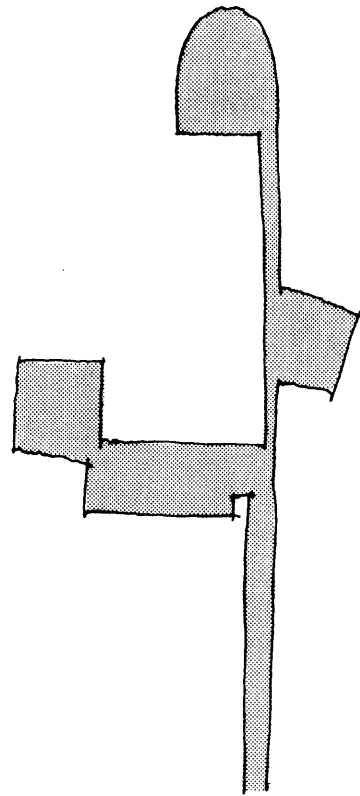
fig. 46 diagram: site connections

MAKING SPACIAL CONNECTIONS - PUBLIC ROOMS

The point of this diagram is to show the importance of the *spine* and the significance of the urban plazas within the campus setting and in relationships to the spine.

The first major urban plaza is located in the center of the site and is the most important nodal point for public life. It is positioned between the two schools and acts as a connector between the *spine* and a smaller, more private plaza in the western part of the site.

A second major urban plaza is located between the break of the two long mass housing blocks on the eastern edge of the site. It makes the transition between the very strongly defined campus and the more *casual* environment to the east; utilizing the existing green mound as an asset to the site. The plaza is activated by shops and cafes/restaurants located in the lower level of the ends of the buildings, as well as by the entry to the school. Through the articulation of the urban plaza and particularly the formal placement of trees the existing mound was brought into the awareness of the people.



N

fig. 47 diagram: public plazas

PUBLIC NODAL POINTS

Auditorium - As part of the school it is used both as a school assembly hall and, more importantly, as a community auditorium for theatrical productions, film screenings, community meetings etc. Incorporating the larger community into parts of the school environment is a way of joining different age groups within this educational setting.

Library - This public library is of dual nature. One part of it is for adult use and its entrance is from the Allee der Kosmonauten. The other part is a children's library, entered from the more sheltered back side. Libraries are important features in the functioning of a campus as such they are a crucial amenity to the community as a whole.

Amphitheater - This programmatic element was very important to me from the beginning of the design process, first as a formal element to the site, but more importantly as a communal feature to the population. Informally nestled within the *designed* natural landscape--for the site was completely level to begin with--it makes an important pole of attraction at different levels. It lends itself to different formal and informal gatherings, theatrical productions, musical festivals, and also to the inhabitation by individuals seeking solitude.

Recreational Facilities - During the school hours the gymnasium and pool will be used by school children, however it becomes available to the community in the evenings and on the weekends. The concept for this building is to appropriate the existing mass housing block and to push the swimming pool through the opening between two load bearing concrete panelled walls.

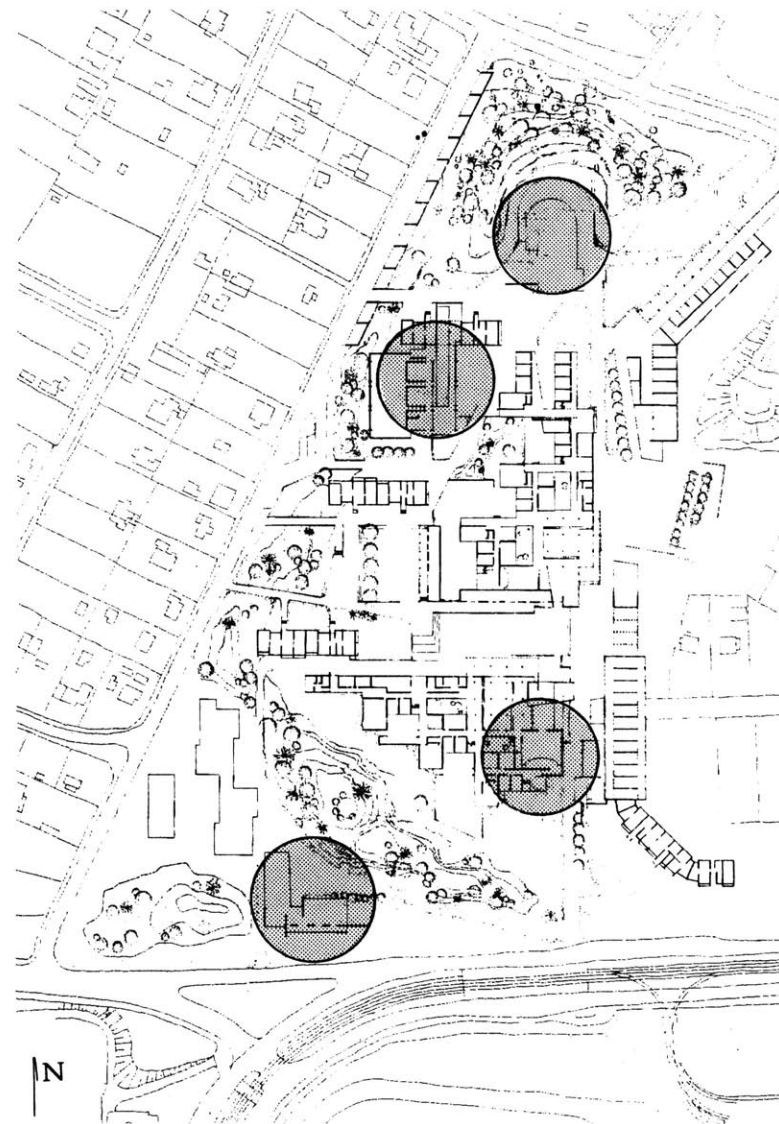


fig. 48 diagram: public nodal points

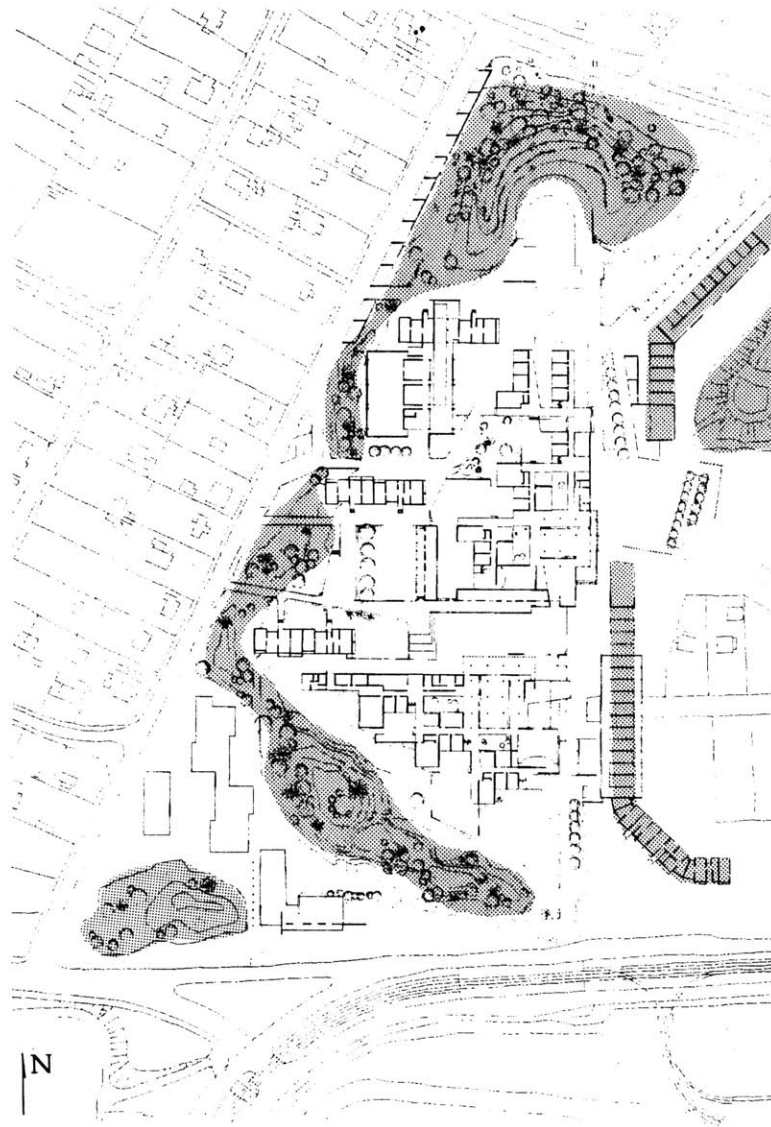


fig. 49: diagram: site edges - landscape design

SITE EDGES - LANDSCAPE DESIGN

In order to create an automobile-free interior within the site Fichtelbergstraße no longer exists. Small portions are used to allow access into the parking facilities at the southern and northern edge of the site.

The eastern edge of the site is defined by eleven story mass apartment buildings which create an impenetrable edge to the site. Within my proposal I *eroded* the lower level at selected place in the building in order to make a connection across, thereby creating accessibility from either side.

The southern part of the site is defined by a mound of natural landscape, which also threads along the western and northern edges. This picturesque landscape provides a relief from the the formally designed campus, but much more importantly from the harshness of the overwhelming scale of the existing mass housing blocks.

Before intervention the site was completely level, providing no variety of experience in scale. By using construction gravel these hills can be built up and forested into a natural landscape.

Parking facilities are provided on the western edge of the site in a simple roofed-over structure that is submerged into the hill of the landscape.

SCHOOL BUILDINGS

Two school buildings are placed within the campus ground. Their primary population is middle and high school children (Gymnasium). However, these buildings are also used for adult re-education during afternoon hours. Both schools are based on the same principle of spatial organization. The principles that organize the schools, a very clear circulation diagram originating in the interior recess areas then linearly extending all the way into the landscape beyond, has made the most pronounced impact on my overall campus design. In addition, the schools border the urban environment and make formal courtyards.

Even though these schools use the same language, they differ in that the one in the south has a major community pole, its public/school auditorium, and the one in the north has incorporated the elementary school. The elementary school is replacing the programmatic requirement of the East German precast concrete school that I am *demolishing* in the north of this site for the sake of this thesis project.



fig. 50 diagram: school buildings

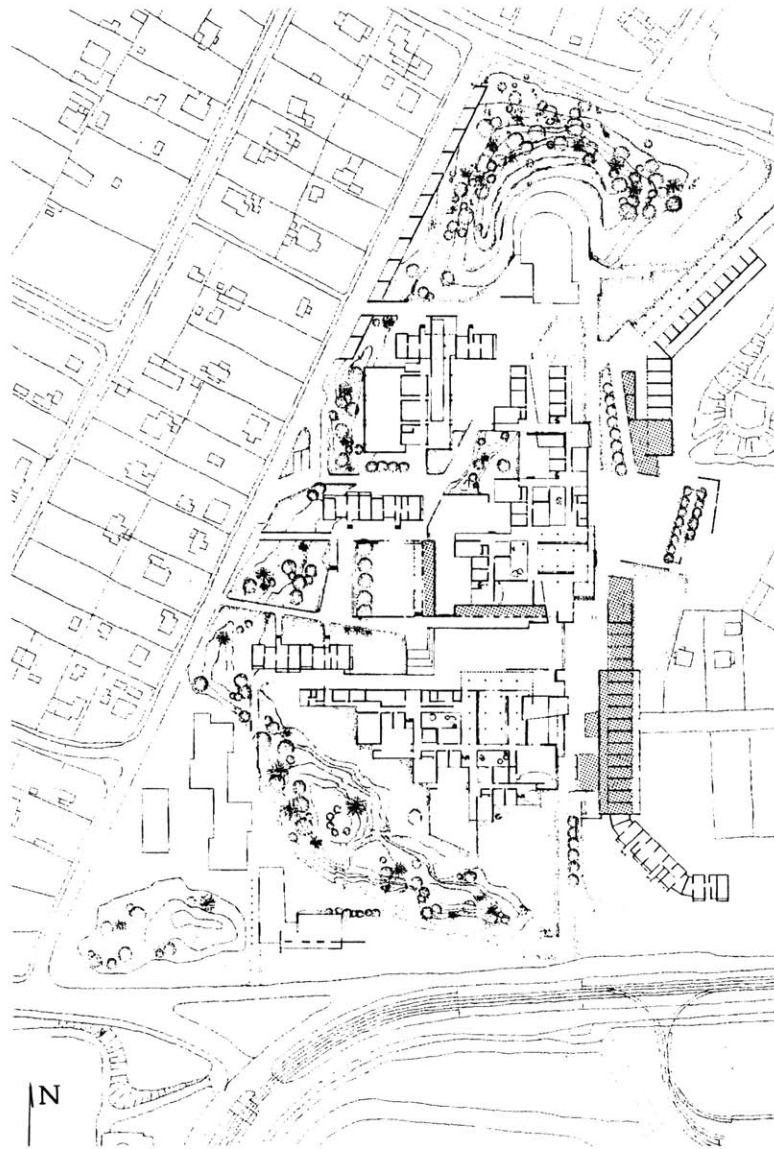


fig. 51 diagram: commercial areas

COMMERCIAL AREAS

The *spine* of the site, created by the existing mass housing blocks, is the facilitator for most of the commercial activities of the site. The apartment buildings will be modified at their base, transformed architecturally to provide the necessary space for this purpose.

Besides the commercial spaces along and inside of the two housing blocks and along the *spine*, more commercial areas are provided in the urban plaza between the schools and in the small plaza on the western side of the campus. These spaces are not intended to distract from the intensity of the *spine*, but rather to activate the respective plazas.

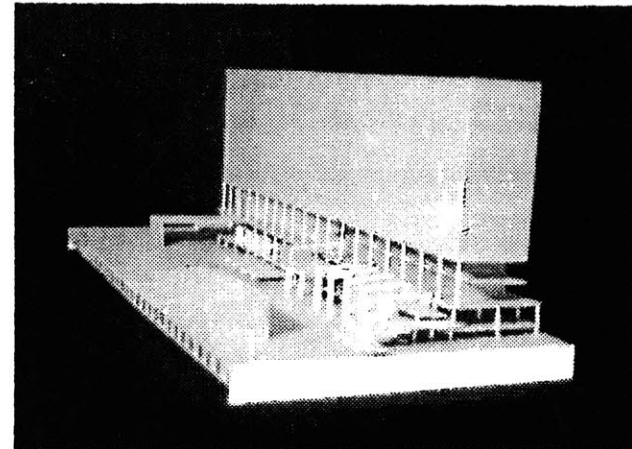
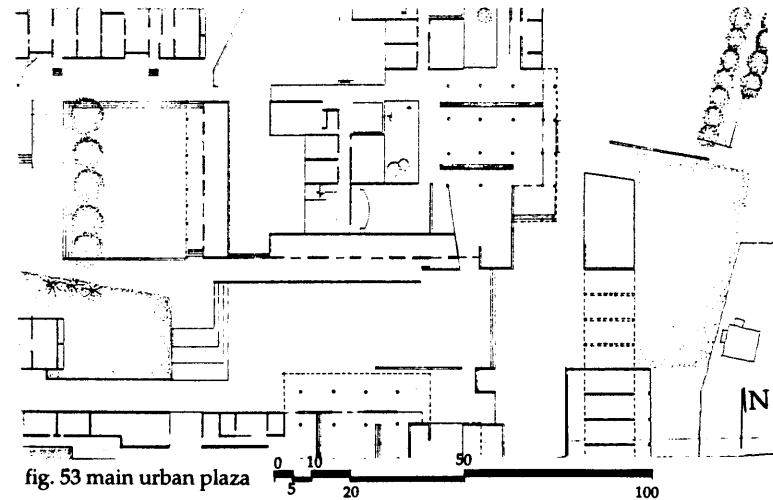


fig. 52 process model: transformation of *foot* of buildings

PUBLIC SPACE

From the beginning of the design process I gave particular emphasis to the position, size, and articulation of this urban plaza. As the center of the site and the campus design, it is a major facilitator of urban and campus life. For that reason it is activated by different functions; slowing down the pace of the commercial spine/street, and connecting to the small plaza on the western edge of the site; to the apartment building and people who live there.

The plaza is articulated by stepped levels. Its position makes it a major amenity to the school community and the whole urban community. The southern side is activated by the entry into the school, the northern edge by commercial activities. The facades of both shorter sides are activated by the privacies of the mass housing blocks. To the west, the edge of the plaza is made by a set of urban stairs that connect the pedestrian to a smaller, more private, plaza serving the inhabitants of the adjacent mass housing blocks. The end condition towards the east of the main urban plaza is made by carving away into the lower part of the mass housing block; creating an urban size opening toward the environment to the east, beyond the boundary of the building.



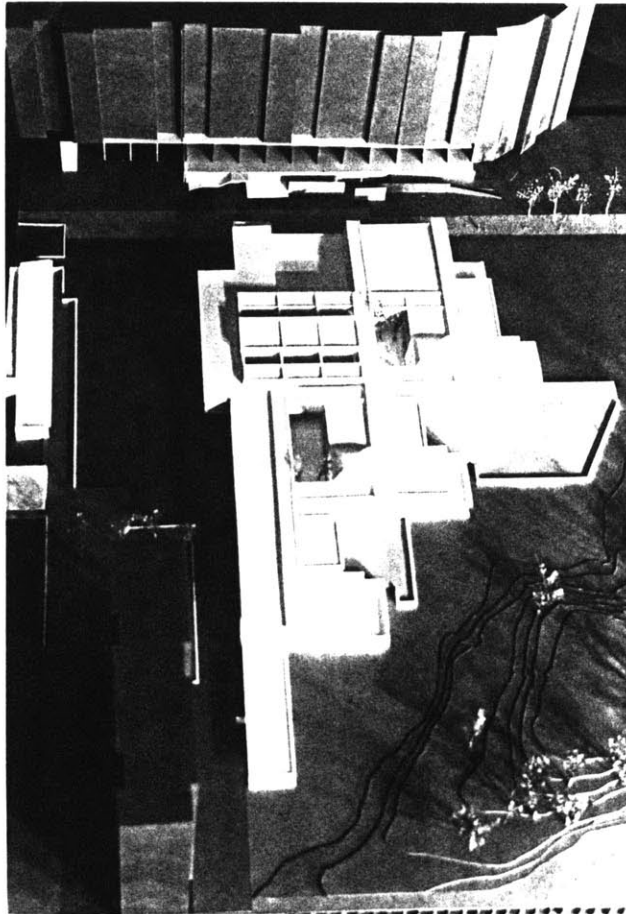


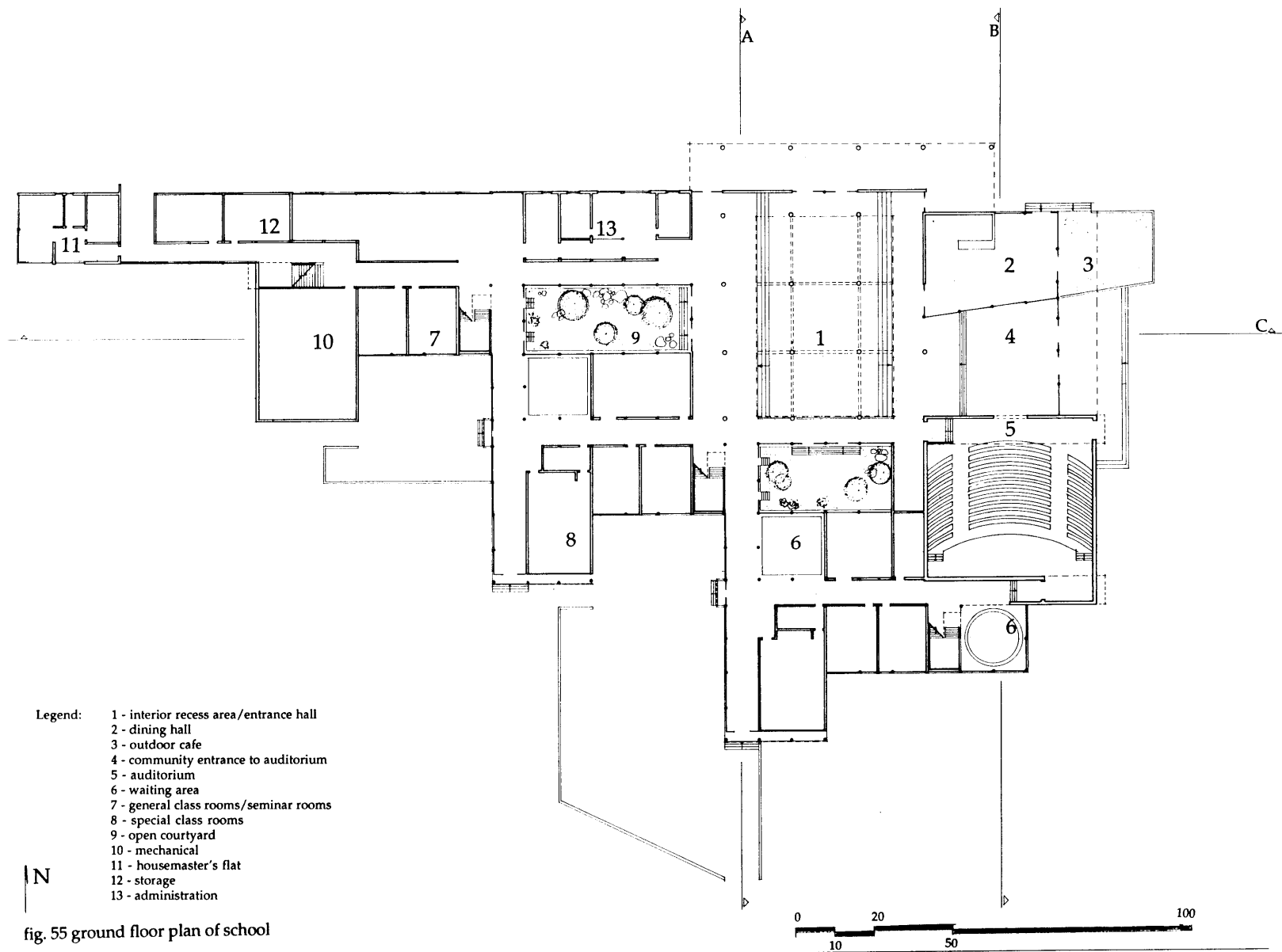
fig. 54 birds-eye-view of school seen from west

THE SCHOOL

Detailed architectural principles were developed for the southern school that take into consideration all the local conditions within which the school is located: entry from the urban plaza, adjacency to the commercial spine, and the southern natural landscape condition. The northern school is based on the same organizing principles, however the exterior conditions of its placement within the campus demand different adaptations to the main organization.

The two story schools are organized in clusters connected rigorously by hallways that lead from the main interior recess space/entrance lobby to the landscape beyond. Since the design of the campus is meant to work toward building community and identity within this area, the school building in itself reflects that philosophy. The conceptual idea of creating clusters is a means of enhancing identity in the school community. Each cluster is to house two grades of school children between grades 6 to 11.

The organization of repetitive clusters is not a rigid system but rather maintains richness when local adaptations are required for the functioning of the school. This school is not solely for use by middle and high school children. It also serves as an institution for adult re-education. As such it will be used during the afternoon and evening hours.



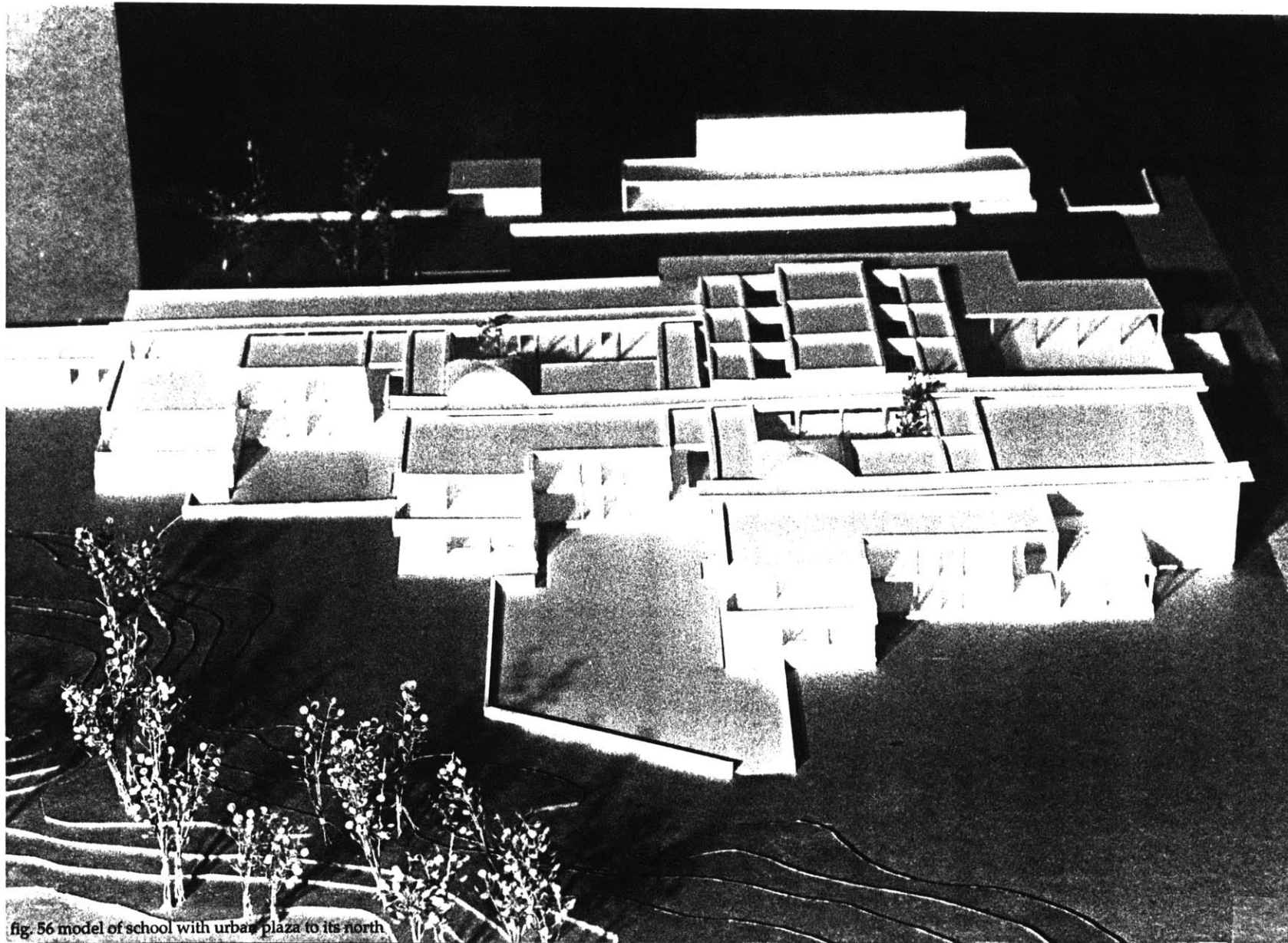


fig. 56 model of school with urban plaza to its north

Careful manipulation of the dimensions of the constructional grid is required to achieve a consistent language for the whole building, particularly when larger special programmatic elements are part of this system, as in the case of the community auditorium.

The entry to the school is from the urban plaza on the northern edge. The urban plaza reaches into the school and becomes the interior recess area—a *plaza* for the school—creating and encouraging the overlap of communities. The entry to the community auditorium within the school is from the east, from the *spine*. It leads the public into an auditorium lobby area, which is open to the school's interior plaza but set apart from it by a few steps. The school's dining and cafe area, to the side of the lobby, are available to the public and the auditorium schedule. The cafe has an outdoor area that becomes part of the life along the *spine*.

The clusters, composed of special and general class rooms, staircases, and waiting areas, and hallways, which connect into the landscape, are expressed in the roof plan. The importance of the interior recess area in the functions of the school and as a representation of community assembly is expressed in the articulation of the roof that covers it. This roof is of much greater height than the surrounding once. It is supported by an 8 m x 8 m column grid. Light can penetrate through at selected places, illuminating the expansive recess plaza/assembly hall.

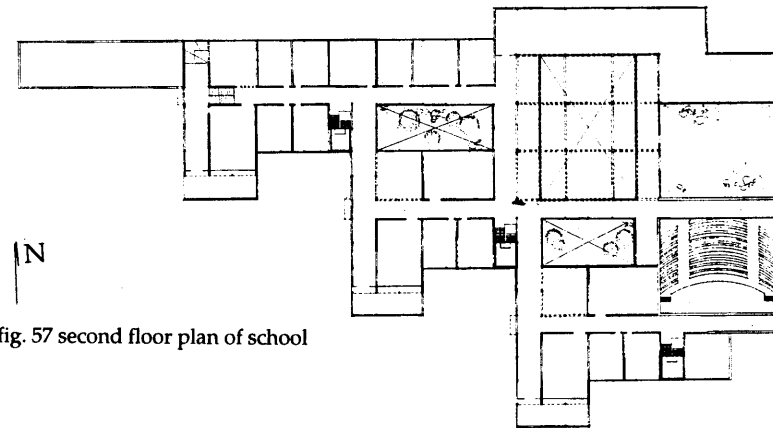


fig. 57 second floor plan of school

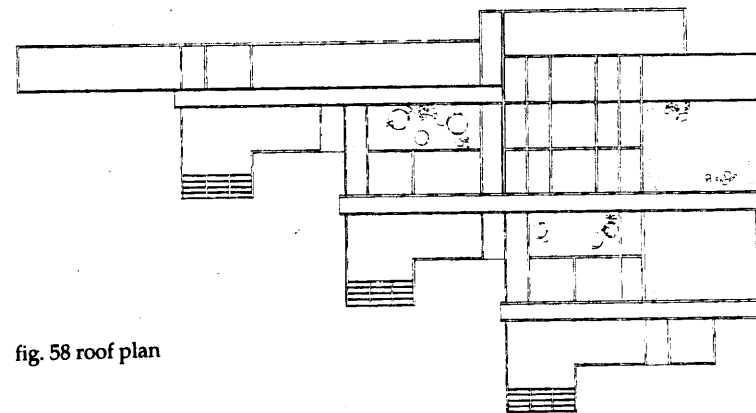


fig. 58 roof plan



fig. 59 diagrams of construction east-west direction

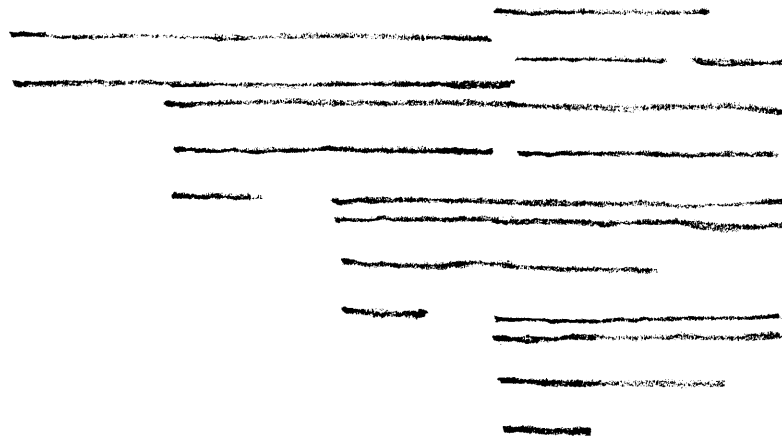


fig. 60 diagram of construction north-south direction

CONSTRUCTION SYSTEM

The school is organized with a grid constructional system. The grid is based on a regular 4 m interval in east-west direction. In the north-south direction, the grid follows an 8 m - 8 m - 3 m rhythm. The three meter dimension is used for the hallways in the east-west direction. The eight meter dimension is suitable for the depth of a normal class room. The construction system is load bearing columns with concrete block infill walls. The columns carry the load of concrete waffle slabs, which are used in an open and exposed way in the classrooms. Waffle slab construction will also be used for the roof construction of the classrooms. However, the hallways are covered with a cast in place continuous concrete slab. This roof is raised higher than the surrounding roofs, allowing for light to penetrate into the corridors. More importantly, the roof construction reflects the interior organization of the school into clusters.

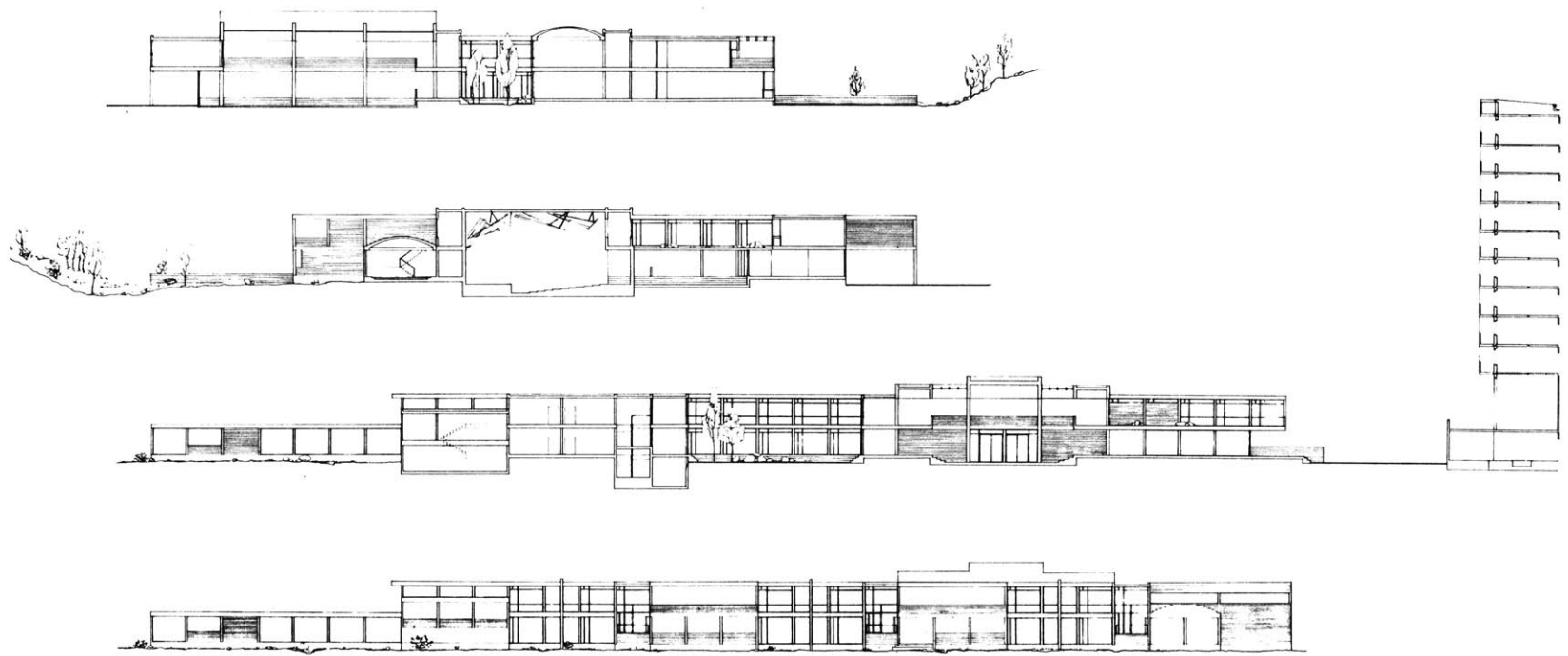


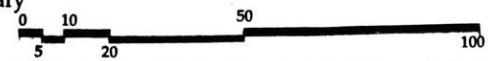
fig. 61 top to bottom:

section A: interior recess, courtyard, waiting area, class rms

section B: waiting area, hallway, auditorium, hallway, community entrance/roof garden, dining hall/library

section C: class rms, stairs, courtyard, interior recess, community entrance/roof garden

south elevation



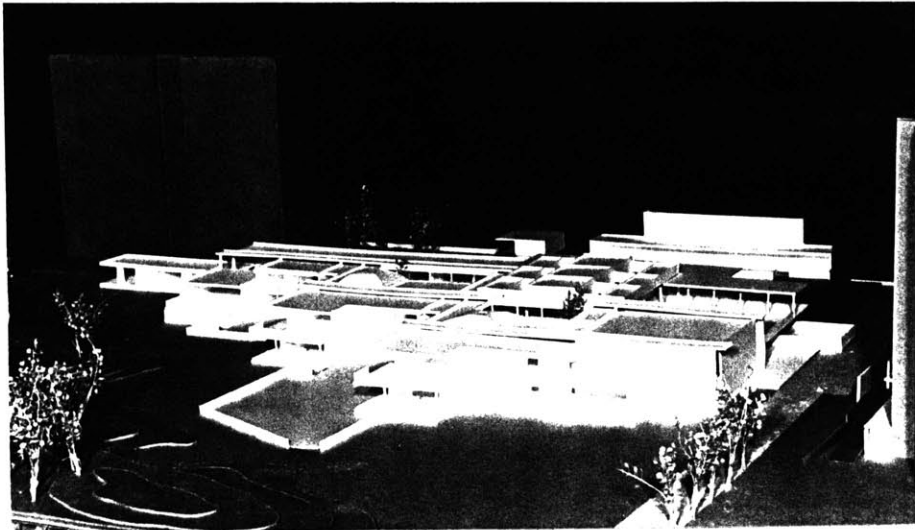


fig. 62 birds-eye and elevation view of school from south-east



fig. 63 birds-eye and elevation view of school from south-west

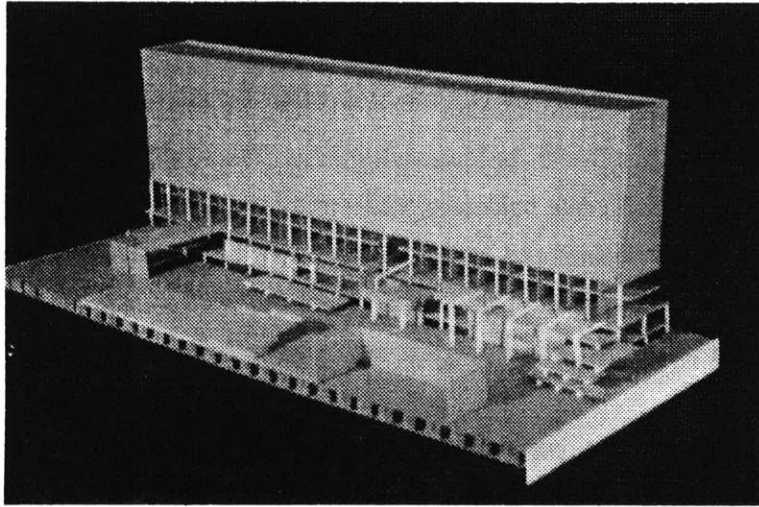


fig. 64 process model: transformation of *foot* of mass housing block

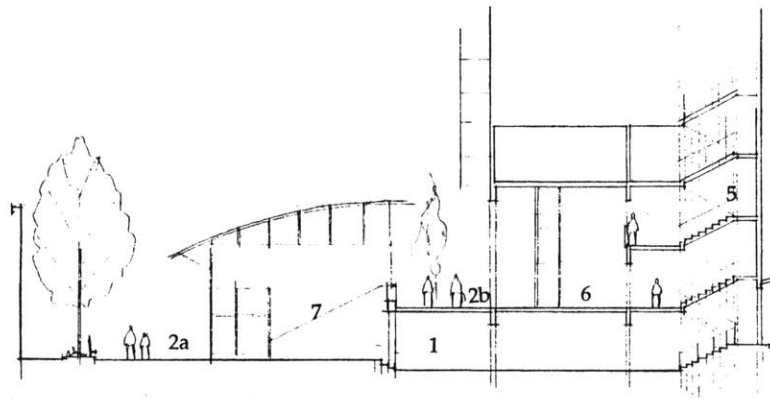


fig. 65 section of transformed mass housing block

THE COMMERCIAL SPINE

The housing blocks that define the *spine* of the site are transformed at their *foot* to incorporate a transitional zone between the public and the private realm; to change the way people enter into their apartment buildings, to fulfill commercial requirements, and to solve some of the parking problems. By creating a vertical layering of activities, from most public to private in a hierarchical way, a situation similar to a section of a town on a hill can be achieved. Through this strategy, levels of overlook and different degrees of urban life can be established. It is a way of partaking in urban life by visual connection. For the person walking towards their apartment unit it is similarly an act of passing through a sequence with degrees of public life.

The ground floor of these buildings will be enlarged to act as a parking garage. People park within the walls of the existing building, arriving from the rear side. The roof of the enclosed garage provides the platform for an elevated pedestrian *street*. The two floors up from this newly developed street level are devoted to the life of the *street*. They are inhabited by different functions, shops,

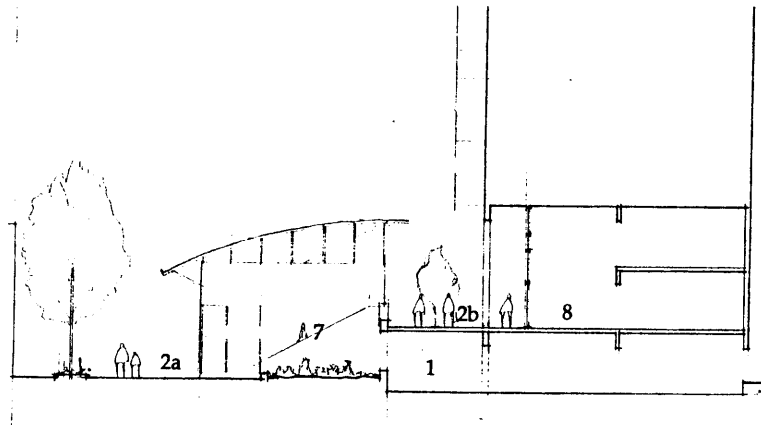


fig. 66 section

level through a double height lobby. At different points of the building the section of the *foot* changes, providing variety. Architectural and material manipulation are most varied in the section of the building that fronts the lower lying street. Here double and single height shops, cafe balconies, pedestrian entry into the parking garage, staircases and ramps between the different levels of the spine are made of a lighter constructional system and contrast with the monolithic characteristics of the apartment blocks.

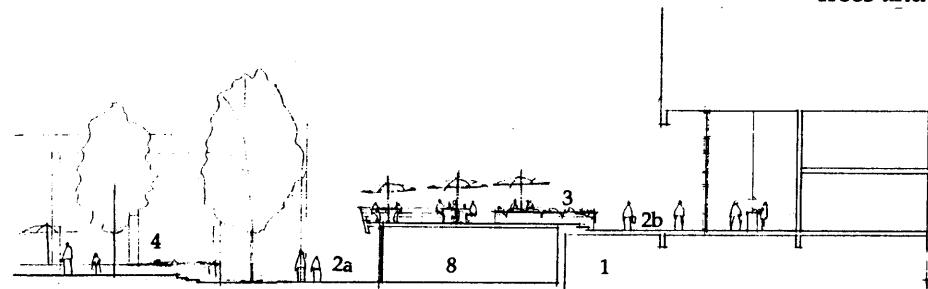


fig. 67 section

Trees and plantings are on both street levels.

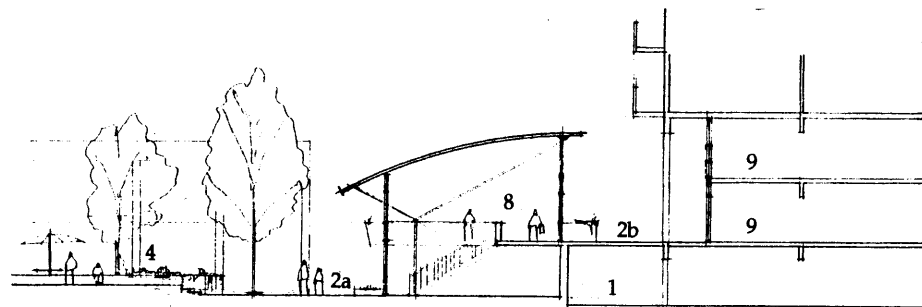


fig. 68 section

- Legend:
- 1- parking
 - 2a - lower street
 - 2b - upper street
 - 3 - elevated plaza
 - 4 - urban plaza between schools
 - 5 - access stairs of apartment bldg.
 - 6 - double height entrance lobby
 - 7 - access between streets
 - 8 - new shops
 - 9 - offices

CONCLUSION

In these final comments I want to again point out that it is our responsibilities as architects and planners to be more than problem solvers. Our approach must always be of a dual nature. We must address the needs of a given site (programmatic/functional requirements) together with the needs of the people (social and psychological circumstances). Only then are we addressing all the existing conditions, not merely working in a self-fulfilling manner.

It is a concern for the people in places like Berlin-Marzahn that pushed me to find an appropriate solution to the complexities of mass housing environments that have for too long been left untended.

A campus is a very complex and sensitive environment designed for the intellectual growth of its members. To that end, I agree with Thomas Gaines when he writes:

"To succeed as a work of art, a campus should be the collaborative product of social scientists, planners, architects, landscape designers, scholars, and naturalists." (Gaines, p. 4).

ACKNOWLEDGEMENTS

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My family, who has always been by my side, for your support and love that has been with me throughout.

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To my thesis colleagues, particularly Charlotte, for your support and humor.

To my dear friend Steven, thank you for being by my side, and helping me out when I could hardly go on.

PROGRAM

GYMNASIUM #1 and #2 have the following spacial r equirements, which are taken from the brief of the Gymnasium presently under construction at the site opposite the one for this thesis.The original program isto make two smaller schools.

STUDENTS IN MIDDLE SCHOOL	300
STUDENTS IN HIGH SCHOOL	175
TEACHERS	40

	#of seats	A	#	total A
GENERAL CLASS RMS	30	65	10	650
GENERAL CLASS RMS	30	65	3	163
SEMINAR RMS	25	50	4	200
SEMINAR RMS	20	40	3	100
TEACHING MATERIAL		20	3	60
		SUM:		1172.5

LANGUAGE LAB	8	40	1	40
AUX. RM.		20	1	20
COMPUTER CLASS RM.	16	80	1	80
		SUM:		260

ADMINISTRATION

HEADMASTER		25	1	25
ASSISTANT HEADMASTER		15	1	15
COORDINATOR		15	1	15
SECRETARY/KITCHEN			1	30
FIRST AID		10	1	10
PARENT'S CONSULTATION RM.		10	1	10
XEROX		15	1	15
STUDENT REP		35	1	35
HOUSE MASTER OFFICE		15	1	15
HOUSE MASTER FLAT		80	1	80
JANITOR		35	1	35
		SUM:		285
TEACHER WAITING HALL				120

NATURAL SCIENCES

DEMONSTRATION RM.	30	60	2	120
PRACT/DEMO	30	90	3	270
PRACT/DEMO	24	80	1	80
PREPARATION			1	140
ACIDS		15	1	15
		SUM:		625

<u>MUSIC/ART</u>	#of seats	A	#	total A
MUSIC HALL	30	80	1	240
COLLECTION SP		30	1	30
ART RM.	30	80	1	240
SCULPTURE RM.	8	45	1	45
AUX. RM		35	1	35
COLLECTION SP		30	1	30
		SUM:		615

AULA/ASSEMBLY HALL	300	1	300
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LIBRARY			110
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WC-FACILITIES

BOYS
GIRLS
WOMEN
MEN

EXTERIOR RECESS SPACE (5m^2/student)	2375
INTERIOR RECESS SPACE (0.5m^2/student)	237.5

ELEMENTARY SCHOOL GRADE 1-4

The Sport's Facilities are shared by all the schools.

STUDENTS IN ELEMENTARY SCHOOL	200				SPORTSHALL (22X44M)	1232
					SPORTSHALL (27X45M)	1605
	#of seats	area	#	total area	SUM:	2837
GENERAL CLASS RMS	25	50	8	400		
TEACHING MATERIAL		20	2	40	POOL	800
<u>GENERAL SCIENCES</u>					PUBLIC LIBRARY	450
DEMONSTRATION RM.	25	50	1	50	CHILDREN LIBRARY	400
PRACTICE RM.	25	80	1	80	COMMERCIAL	2800
MUSIC	25	70	1	70	PARKING	800
ART	25	70	1	70		
AUX. RM.		20	1	20		
<u>ADMINISTRATION</u>						
HEADMASTER		20	1	20		
ASSISTANT HEADMASTER		15	1	15		
COORDINATOR		15	1	15		
SECRETARY/KITCHEN			1	30		
FIRST AID		10	1	10		
PARENT'S CONSULTATION RM.		10	1	10		
XEROX		15	1	15		
HOUSE MASTER OFFICE		15	1	15		
JANITOR		35	1	35		
		SUM:		165		
TEACHER WAITING HALL				80		
<u>WC-FACILITIES</u>						
BOYS						
GIRLS						
WOMEN						
MEN						
EXTERIOR RECESS SPACE (5m ² /student)				1000		
INTERIOR RECESS SPACE (0.5m ² /student)				100		

ENDNOTES

The factual content of chapter 1.2 "The Peripheral City" is derived from an interview with Dr. Günther Peters on August 2nd 1995 in Berlin-Biesdorf.

1 - Trancik, Roger. *Finding Lost Space*. N.Y., Van Nostrand Reinhold Company. 1986.p.1.

2 - Ibid, p.10.

3 - Ibid, p.30.

4 - Ibid, p.22.

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6 - Habraken, N.J.. *Transformations of the Site*. Awarter Press. 1982. p.128.

7 - Gaines, Thomas A.. *The Campus As A Work Of Art*. N.Y., Praeger Publisher. 1991. p.11.

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9 - Gaines, Thomas A.. *The Campus As A Work Of Art*. N.Y., Praeger Publisher. 1991. p.x.

10 - Ibid. p.1.

11 - Ibid. p.147.

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fig. 1,2,3,4,5,6

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fig. 7

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fig. 8

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fig. 11

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fig. 21

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fig. 22

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fig. 25

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fig. 26

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fig. 27

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fig. 28

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fig. 29

Gaines, Thomas A..*The Campus As A Work Of Art*. N.Y., Praeger
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fig. 30

*All other photographs, drawings, sketches and diagrams are by the
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